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ABSTRACT

A study initiated in July 1973 had as its primary objective to identify and define guidelines for the appraisal of research in all fields represented at the Pennsylvania State University. Through interviews and selected working papers, a team of investigators inquired into centers of administrative decisionmaking at several levels and in all subject areas of the university. In effect, the study traced the evaluative circuitry of the institution and compared it where feasible with that of other universities and external research agencies. Among matters addressed are: academic evaluative procedures (promotion and tenure, proposal selection, program reviews) as they relate to the conduct of research; ethical considerations; collegial organization; and institutes, centers, and extra-collegial laboratories as research agencies of the university. (MSE)

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THE ACADEMIC ADMINISTRATION OF RESEARCH:

a Descriptive Analysis

March 20, 1975

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U S DEPARTMENT OF HEALTH
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PREFACE

This report derives from a study commissioned by the Office of Research Management Improvement of the National Science Foundation (Grant Number NM 39530) and initiated on July 1, 1973. It was prepared with the counsel and active participation of

Herschel W. Leibowitz, Professor of Psychology

Archie J. McDonnell, Associate Professor of Civil Engineering

Richard P. Parizek, Professor of Geology

Stuart Patton, Evan Pugh Professor of Agriculture

Philip S. Skell, Evan Pugh Professor of Chemistry

all of the Pennsylvania State University. Participating also in advisory capacities were

G. Lester Anderson, Director, Center for the Study of Higher Education

James B. Bartoo, Dean of the Graduate School

Richard G. Cunningham, Vice President for Research and Graduate Studies

Stanley O. Ikenberry, Senior Vice President for Development

The staff of the study consisted of

William E. Toombs, Assistant Director, Center for the Study of Higher Education

Renee Friedman, Center for the Study of Higher Education

Henry W. Sams, Associate Dean for Program Review and Evaluation, the Graduate School (Principal Investigator).

The primary objective of the study was to identify and define guidelines for the appraisal of research in all fields represented at the University. Statements sufficiently concise and prescriptive to warrant the title "handbook" were to be sought. However, the determination was also made to reject hypothetical sets of criteria and to report exclusively those judgmental procedures and

principles which can be observed in actual practice. For these purposes, the effective investigative tactic proved to be interviews which were summarized in protocols, reviewed, and revised; correspondence on selected working papers; drafting, review, and revision. It was necessary to inquire into centers of administrative decision at several levels and through the full range of subject-matter divisions of the university. The process might be described as that of tracing the evaluative circuitry of an institution, and of comparing it where comparisons prove feasible with that of other universities and of research agencies external to the universities.

Information summary:

Name of institution: The Pennsylvania State University

Principal investigator: Henry W. Sams

Grant number: NM39530

Grant title: Study and Development of Methods of Evaluating Research at a University

Starting date: July 1, 1973

Brief description of project and results: A study of evaluation within universities of research in its proposal, project, and publication stages, of the agencies by which judgments are made, of relationships among these agencies, of criteria which pertain, and of the effective sanctions.

List of publications: One hundred copies of the report have been ordered by the Vice President for Research and Graduate Study of The Pennsylvania State University for use in briefing reviewing teams organized by his office for the appraisal of various research programs. The effectiveness or lack of effectiveness with this group will influence further publication plans.

Theses: None as yet or currently in progress.

List of materials available for distribution: None other than the study itself, which is available for use as above if expense of reproduction can be met.

Activities related to dissemination: Copies of the study are being sent to persons whose participation in its preparation was of a magnitude to warrant their mention in the study. Dissemination within Penn State University is mentioned under publications above, and further applications of the study are expected to develop from this experience.

Collaborators: See page i.

H. W. Sams

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Professor of English and
Associate Dean for Program Review
and Evaluation, The Graduate School,
The Pennsylvania State University

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INTRODUCTION

This is a study of universities, typically of a university, with regard primarily to their participation in and support of research in all fields. The procedure is descriptive. The investigators have undertaken to evoke from persons actively engaged in research within the university their sense of the conditions, opportunities, and sanctions which affect them. In so far as possible their emphases are retained in the report, and their own language.

Their names are retained also. In the interest of authenticity they must have opportunity to check the ways in which they have been interpreted, and to testify further if questions arise. The policy of the study is to explore the university itself - the procedures, patterns, and attitudes which are effective within it - and to assume as "given" the larger societal matrix. For this purpose direct representation of the facts as they appear to research-oriented faculty members affords the best available procedure.

Some ordering and arrangement is necessary, of course. The sequence which has been adopted is the one which appears to be least vulnerable to distortion. It begins with a survey of the formally organized means to evaluative judgments of research. These are not the substantive judgments of research itself. New knowledge can be only indirectly a product of administrative decision. These are the operational judgments by which the instrumentalities of research, the faculties and facilities of the university, are formed and developed. They pertain to the acquisition and allocation of resources.

It is with reference to resources that one of the principal limitations of this investigative procedure appears: the availability of resources is not a matter for independent university determination. Academic scientists and other researchers exert some influence on the shape of the total "market" for new

knowledge, both by direct participation and by the impact of their work. But other agencies hold greater powers - agencies of government, industry, finance, and health. To decline responsibility for study of these agencies is not to question or depreciate their influence or the appropriateness of their influence. They are there. They have received extensive notice in the literature of the past two decades. Jerome Weisner's Where Science and Politics Meet (1965) may be cited as exemplary of a discussion which is here deliberately set aside, not in the spirit of contradiction, but in confidence that it is receiving adequate attention elsewhere.

The subject to be explored is a range of operational decisions - namely those pertaining to research - which regularly fall within the competence of the universities themselves. Universities have the capacity and prerogative for definitive decision in some dimensions of their activities. They are also subject to effective constraints derived not only from society at large but also from their own essential structure. Some clarification of these capacities and constraints is the principal objective of this study, which consists of three gatherings of material, "Chapters," as follows:

The first chapter is entitled "Academic Evaluative Procedures and their Relation to the Conduct of Research." It contains a specification of five ways of making judgments with which faculties are routinely concerned, and illustration of them in practice. To a degree the division of the chapter is artificial, a product of expository necessity. The elements of it are demonstrably real. Representation of them in terms of formal procedures is somewhat misleading, for judgments are frequently effected within the ordinary administrative operations

of department or college without recourse to distinct evaluative agencies. Judgments are not always labelled "judgments." Any record of negative decisions is by its nature incomplete. Appointments that were not made or were not continued, research proposals that were not completed or sent forward, projects that failed to prove out and were abandoned do not figure prominently in institutional histories. Formally instituted evaluative procedures represent only partially the evaluative functions characteristic of universities. With regard to research, they might appear inadequate if they were not sustained by other organizational structures within the university. These structures determine the nature of the second and third chapters of the study.

The second chapter is entitled "Collegial Organization and Research." It is concerned with the dimension of university structure thought of as "regressive," "parochial," and tyrannical" by those who are at odds with it, and as "fundamental," "responsible," and "disciplinary" by those who are not. The procedure used in this attempt to characterize the colleges has been to report as accurately as possible the responsibilities, activities, and problems of administrative officers charged explicitly with the conduct of research within the several colleges of the university. These officers are entitled "Associate," or "Assistant" Deans, or "Directors" for research. Their responsibilities do not extend to continuing education and instruction, although some of them take active part in the conduct especially of graduate instruction. Their positions constitute the most immediate administrative involvement in research that is practicable short of assuming responsibility for the substantive issues of detailed research projects.

Although the colleges and departments are conspicuous salients of administrative authority in the university, they are not the fixed and uniform agencies of hierarchy that they are sometimes taken to be. Within the universities pressures for redefinition, development, and change are constantly present and occasionally intense. The language by which these pressures can be most clearly represented derives from experience with institutes, centers, laboratories, and other less formally designated aggregates of research capacity which occur frequently on university campuses throughout the country.

The third chapter is addressed to this experience. Interdisciplinary, intercollegial, interdepartmental research involving persons identified with a variety of administrative organizations and of intellectual disciplines is undertaken and maintained in more or less uneasy equilibrium with departmental and collegial entities. In a sense, the relationship constitutes an additional and more comprehensive evaluative function, for it requires judgments at every level of academic concern, from high-level institutional policy and resource allocation to the individual scientist's appropriation of his working hours and the graduate student's selection of a dissertation topic and director.

Emergence of a new interdisciplinary emphasis can lead to any of three ultimate developments:

1. The creation of a new academic administrative agency of whatever magnitude and degree of independence the circumstances require,

2. Modification of existing departments or colleges to accommodate new purposes, with appropriation of time and facilities derived either from reduction of old activities or from the creation of new resources.

3. Failure of the emphasis to generate energy and interest to the degree required to modify existing structures.

There is a natural tendency for individuals to generalize issues of this kind and to recommend at one time that more new ideas ought to succeed, and at another time to complain that public urgency is getting in the way of proved knowledge. In a similar spirit novelists may sometimes be moved to say that people ought to read more novels, and pianists that people ought to go to more recitals, but the novelist's basic concern is for his own book, and the pianist's for his own music. In the same way every revision of the structure and activity of a university involves resolution of the particular question at issue, in its own terms and on its own merits. How this process works is reflected in the attitudes of faculty members confronted by the general question of continuity and change in relation to their own fields of special interest. The third chapter, entitled "Institutes, Centers, and Extra-Collegial Laboratories as Agencies of University Research" provides a medium through which these faculty attitudes can be projected.

Some efforts in the direction of generalizing the study, of including within it commensurate materials from a number of universities, have been made. How many samples would be needed in order to give the observations which are made genuine validity for American higher education in the large is problematical. What has been done here suggests that the sample need not be very much increased. There are marked resemblances. The record of interviews on two major campuses and of a survey of publications collected from forty-six campuses are included in Appendices to which reference is made where significant differences or similarities are apparent. Exhaustive development of this beginning might possibly produce results of value, but it lies beyond the competence of this survey.

The descriptive, photographic point of view from which this study has been made tends to result in a view of things as they are, or as they are understood

to be by the people involved in them. Insofar as such a study suggests arguments or recommendations, the argument inevitably supports the status quo. The topic is sometimes referred to as "the Keokuk argument" - this is the way we do it in Keokuk; therefore, this is the way it ought to be done.

But the study is not designed to function argumentatively. It essays to present the "givens" of the university as an instrument of research. By the way, it provides some indication of the impact on universities of the thirty years since research itself achieved large-scale institutionalization. Beyond this study lies a longer and much more difficult task, that of using the universities to improve the scientific and intellectual powers of a society which appears at times to value these powers highly and at other times to value them not at all. Similarly the universities appear at some points inattentive to societal interests, and at others available for assignment to almost any activity that seems likely to win public notice and support.

A philosophical matrix into which all the forms, ideas, operations, and purposes of intellectual inquiry fit neatly and rationally is not readily or consistently available. Like the society of which they are parts, the universities, all of them, are eclectic to a degree somewhat short of chaos. Suggestions for their re-ordering are in good supply. Agreement on any one suggestion, or on any one set of suggestions, is somewhat harder to come by, although adjustments in large scale and in small are constantly in process.

Among these adjustments is a tentative acceptance of the principle that research, together with the performance of students in the course of their education, is subject to methodical appraisal and to the application of whatever sanctions are justified and practicable. Appraisal, however, implies standards, and methodical appraisal implies that standards should be uniformly and equitably applied. This is a point of difficulty - not because the university is without standards, but because it has many. Criteria are more readily defined than

systematized. For example, every research project may reasonably be expected to prove itself valuable either

1. Economically, by contributing more than its own costs to society in the form of goods and services, or
2. Fiscally, by winning support in the form of grants or contracts, or
3. Ethically, by demonstrating vitality and definition of purpose on the part of the researchers, or
4. Productively, by making new information of significance available, usually through publications, to an appropriate clientele, or
5. Professionally, by clarifying the researcher's status in his field and thereby contributing to the definition of one of the hierarchies of intellectual authority, or
6. Competitively, by impact evidenced through strong response - citations, invitations to lecture, honors, the Nobel Prize, or
7. Methodologically, by demonstrating virtuosity in the use of complex investigative procedures, by refining such procedures, and developing new ones, or
8. Educationally, by
   a. demonstrating the researcher's authority to teach, or
   b. expanding and re-ordering the range and structure of understandings available to be taught, or
   c. contributing to the capacity of students to continue and expand programs of investigation, or
   d. attracting new students and faculty members of superior talents, or
   e. giving visibility and authority to an institution or to an agency within it.

All of these criteria have validity, but they do not all apply with equal force or in all circumstances. For example, the compiling of a dependable dictionary of Middle English invites application of items in the list above that are different from those which would apply to devising a new system for disposing of urban sewage. In spite of the disparity of any two such undertakings in terms of the criteria which pertain to their evaluation, a university may assign to both the overriding values of quality and utility when they meet their respective sets of standards, and regard both as essential elements in the comprehensive scheme of academic research and instruction.

What criteria apply in any particular situation, and by whom they are applied, are questions which require examination on an operational level. Rationalized sets of categories and objectives are interesting, but they are too broad for particular discrimination between research of the first and research of a lower order of priority. The university improves upon the condition of ordinary stubbornness in that it has many minds of its own. How these minds propose to work together without radical disunification is not a new story, although it is constantly changing. The story indicates ways in which a great many judgments are made, and are made effective, and for that reason materials for retelling it are here assembled.

I

Academic Evaluative Procedures

and their

Relation to the Conduct of Research

"I cannot read an account like this, which is full of the false starts and ignored leads so typical of a passionately important scientific quest, without anxiety at the evanescence of some of the most important evidence: a remembered scrap of conversation, notes scribbled on the back of a haphazardly-preserved program of a scientific meeting."

- Victor McElheny in a review of The Path to the Double Helix, by Robert Olby. NYT Book Review, March 16, 1975, p. 23.

Introduction

> Both the wise direction of inquiry, lest the energies available to it be sapped by pretentious novelty, and the wholehearted support of genuine innovation--as well as wise judgment as to which is which--depend upon understanding explicitly what the causes of growth are.[1]

The first requirement for sound judgment of the quality and value of research is that the judge be at least one degree superior in knowledge and understanding to the researcher whose work he appraises. This being true, there are sometimes and for limited periods of time extraordinarily gifted and fortunate persons for whom no fully qualified critic can be supplied. Even so, and even for these few, judgment, appraisal, or evaluation is a constant and indispensable element in the daily experience of those who search for new knowledge. Judgment is the means by which understanding is confirmed and disseminated. Understanding and appraisal are aspects of the same event. Encounter with a new idea implies the question whether it is a right idea or a wrong one. Resolution of such questions requires intellectual competition, an atmosphere of mutual criticism and inquiry among men of complementary knowledges and purposes. Evaluation and community are necessary and natural conditions of growth in science and scholarship.

The researcher has no alternative but to seek actively the criticism of his peers. If he is fortunate, they are near at hand--in his laboratory, department, or college. But the relatively comfortable relationship with which he became familiar as a student and candidate, in which he referred to his adviser whenever occasion arose, does not continue indefinitely. His circle

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[1] Richard F. Storr, The Beginning of the Future, A Historical Approach to Graduate Education in the Arts and Sciences (New York: McGraw-Hill, 1973), p. 74.

of critics grows more impersonal, objective, and remote as he advances in his field. He learns what other persons are doing his kind of work, whose judgment he would value most, and whose approval he has no choice but to win. The attention of the jury he selects is not automatically available to him. Part of his responsibility is to make his voice heard. Nor is the prerogative of selection exclusively his own. Universities permit a considerable degree of privacy for those who demand it, but research is a public matter and persons who conduct it are agents of a public concern. Although the appropriate audience of any particular undertaking may be select and small, the ultimate responsibility to submit to its judgment is inescapable.

Some such responsibility is implicit also in institutional and academic position. The office, laboratory, or study that the researcher occupies has presupposed functions in the academic society. It is a tool to be used in certain predisposed ways which may or may not be conceived of exactly in accord with the conceptions of the individual who uses it. The individual and the institution each have the capacity to form habits and develop expectations, and either is capable of absorbing the other's interests into his or its own.

Ideally, no such capitulation of identity would ever take place. The individual by his strength and wisdom would reshape and expand the institution to accommodate him. The institution, by its strength and wisdom, would enable the scholar to discover talents he didn't know he had. But the ideal is not always what happens. The failure can be on either side. The individual scholar may be wrong in judgments, erroneous or inadequate in knowledge, or mistaken or inaccurate in operation, and the institution may find him wholly satisfactory. On the other hand he may be correct, learned, and precise and yet fail, as the saying goes, to be appreciated. Instances can be cited of both aberrations, but it is discrete to use only the second: at different times John Dewey, Thorstein Veblen, and George Sherburn all encountered disfavor at a single university,

although that university retains and deserves a reputation for probity in such matters. If such men can meet disapproval, what young scholar can be entirely secure? Universities, like the individuals who constitute them, are essentially evaluative entities. They have to make judgments because they seek to understand, and the grounds on which their judgments are made cannot in a good university remain static. The canons of understanding and appraisal, whether with respect to a precisely defined field of learning or to the entire range of knowledge which a university represents, are constantly renewed.

This desideratum is not always an accomplished fact. In any artifact the perfect adjustment of parts and whole is a Greek ideal honored in approximation and only dreamt of in perfection. Universities and other polities are artifacts in this sense. The quality of a university and the quality of an inquiry carried on within it are related as whole and part. Each is dependent upon the other. Richard Storr[2] describes the situation as follows:

> The present situation is both expansive and fluid; but does the organization of graduate studies reflect as much as it might the promise that the situation holds? The development of methodology, discipline by discipline, and the further study of inquiry as such have yet to be thought of generally as complementary activities, each of which will be the more fruitful where the results of the other are kept explicitly in mind. Inquiry into the nature of inquiry can of course be maintained as a specialty, but it will not be wholly effective until its findings permeate the culture of the academy. In the light of that possibility, there is the prospect that the development of particular methods and the exploration of inquiry itself will be advanced as parts of a single process. It can be the intention of the graduate school to provide not only that an appropriate method is devised to match each particular line of inquiry that some scholar or scientist may wish to pursue, but also that no approach to inquiry is left untested for want of experimentation with method. Whether the word research is restricted in usage to empirical investigation or is applied broadly to cover any proven mode of thought is an issue that should be settled--but by agreement on definitions. What matters in substance is whether the graduate school should provide the student with a context of life, as well as a degree program, that encourages such inquiry as is both rigorous and free.

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[2] Ibid., p. 75.

Storr's recommendation for the universities combines the pursuit of hard questions about scientific, social, and humane problems with the ideal of a maturing institutional epistemology. Research, as he sees it, should yield knowledge; in addition, it should develop an understanding of how men know. His conception goes somewhat beyond that of field methodologies, the professional self-consciousness by which sociologists are recognizable as sociologists, medievalists as medievalists and so on. He explicitly depreciates the idea of intellectual method as a specialty in itself. Accepting the number and variety of the "lines of inquiry" in which universities engage, he proposes that in all of them, whether separately or collectively considered, the university fulfills its essential function only as it proceeds both directly and reflexively, observing the data of its problems and the data of its own resolution of them with commensurate objectivity. Stated in another way, discovery is linked with an expanding capacity to discover.

Storr's idea may seem ambitious to the point of being visionary. From a market-oriented and industrial point of view he would appear Quixotic. Yet there is much in the accustomed forms and practices of the universities which suggests that he is describing accurately what the men there are trying to do. Partly because university research is firmly joined with instruction, and partly because in the nature of things, understanding per se continues to be an end in itself, the means of achieving knowledge remain under constant revision, even as knowledge expands.

This duality of concern is reflected in the ways in which academic judgments are arrived at and expressed. They constitute a useful point of departure for consideration of new dispositions and procedures which will assuredly be needed in the giant universities which have grown up since World War II. For the purpose of understanding where the universities are now, it should be useful to survey and

illustrate several of the overt and more or less formal modes in which academic judgments are currently expressed. The pattern of illustration must be reductive; its categories are neater than the actual practice to which they pertain. Each illustration, however, is actual; each is drawn from experience on either an operational or an experimental basis. The descriptions are phrased as if in answer to questions from men beginning academic careers or older men worried about deferred rewards. Men in these situations frequently ask for specific information on what is expected of them; the tone of the questions is not always exclusively interrogative. The answers which follow may be informative, but not necessarily definitive.

The kinds of evaluative judgments which seem most pertinent are these:

1. judgments of persons--because it is this mode of judgment which is preeminent in the consciousness of university faculties;

2. judgments of proposals--because the proposal has become, partly under the influence of governmental agencies, the recognized unitary item in all considerations of research;

3. judgments of projects--because the idea of administrative monitoring of research in progress persists in faculty discussions;

4. judgments of programs--because it is on this scale of appraisal that universities have responded most actively to the demands of the times;

5. judgments on ethical criteria--because this is the area of concern now most explicitly organized in terms of procedural and legal rules.

PERSONS: Promotion and the Award of Tenure

> ". . . the principal means by which the faculty exercises control over the quality of the scholarly activities of its members is through its role in recommending the selection of its own members and through professional standards that it and the University apply in the selection process."[3]

All other modes and topics of evaluation in universities are qualified by the overriding importance both to individuals and to the institution as a whole of the selection of permanent faculty and the hierarchical organization of faculty in terms of professorial ranks.

Selection of faculty is controlled by initially tentative appointments and by subsequent award or denial of "permanent" or "indefinite" tenure, with its implication of commitment on the part of the institution to the individual for the term of his professional career. Pros and cons of this basic procedure of American higher education have recently been thoroughly reviewed in Faculty Tenure,[4] popularly referred to as the Keast report, and in the discussion which this publication evoked. The matter is too familiar to require elaboration other than to remark that it is a fact of academic life. Also, it tilts evaluation of intellectual quality in the universities toward the twenty- to forty-year span of a professorial career, within which the one- to five-year span of a single investigative project may appear as an important but subordinate item.

Award of indefinite tenure to a scholar with a particular research specialty is a research decision in that it commits the institution to the specialty as well as to the individual. Denial of tenure may represent a decision to the contrary effect.

The long time-span encompassed by the tenure commitment has a tendency to advance fluently adaptable competency over sharply limited expertise. Research

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[3]Harvard University, Report of the Committee on Criteria for Acceptance of Sponsored Research in the Faculty of Arts and Sciences (Cambridge Mass.: Harvard University Press, 1970), p. 3.

[4]San Francisco and London: Jossey-Bass Publishers, 1973.

projects come and go, but research faculties remain. The conflict of values implicit in this situation is important in the nature of evaluative processes. There is an apparent difference between faculty best qualified for the job in hand and the faculty best qualified to meet the unknown next phase. Contributing to this conflict is the impact upon research of a concomitant instructional program, in which the permanent health of a discipline, and of the practitioners of it, requires a longer range of vision than does the resolution of a particular problem.

Either of these polarities is capable of inspiring excessively emphatic advocacy, and in practice the constant realignment of differences is accompanied by heat and noise. Errors of judgment occur. For the young man seeking concrete, definitive advice on what is expected of him, the available answers are often frustrating.

But in fact the necessities of the situation preclude simplistic answers. Crisp, efficient execution of the immediate assignment is indispensable, but so is the capacity to define an assignment with reference to its broad disciplinary context. There is no comfort in the fact that while he ponders his predicament the candidate may find himself deprived of institutional support. No less radical in its effect, although less shocking at the moment, is the facile affirmative by which the individual may accept long-term responsibilities ill-suited to his talents and interests.[5]

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[5] An example of the kind of general statement generally used to describe criteria for promotion in policy manuals is as follows:

1-a. Teaching Ability. This includes the ability to make students think critically and purposefully, the ability to interest students in the broad problems of the course, the ability to construct honest instruments of evaluation and to interpret the results impartially, and the ability to maintain sound academic standards.

Continued

or 1-b. Research Ability. This includes the ability to train students in research; to lay out a tentative theory and to plan the experiments for testing; the ability to design the equipment and construct or instruct others on how to construct it; the ability to direct assistants, operate within a planned budget, and present the results of research in a form easily understood by one's colleagues and by laymen.

or 1-c. Librarianship Ability. This includes the ability to use bibliographic tools, the ability to supervise effectively large areas of work and to maintain sound academic standards; the ability to direct assistants and operate within a planned budget.

2. Scholarship. This includes not only academic preparation, but also evidences of continuing scholarly growth as exemplified in both published and unpublished contributions to knowledge.

3. Character and Personality. The faculty member must possess those qualities of mind and spirit which will merit emulation by the students: fairness, open-mindedness, objectivity, tolerance, patience, and a saving sense of proportion.

4. Academic Responsibility. This phrase is intended to suggest that the faculty members should make a genuine contribution to the program of the institution and of the academic community by conscientiously advising students, by efficient administration of one or more units of the university organization, by participation in the work of important committees, etc.

5. Professional Development. The faculty member is expected, whenever possible, to maintain an active interest in the program of professional societies and to develop, as his experience grows, an understanding of the broad national and international aspects of his special field of interest.

6. General Qualifications. The faculty member should possess, in addition to the qualities listed above, the minimum standards for each rank.

Ideally every decision to deny or to award tenure would contribute to the development of a community of persons in which each member maintains authority in his special modes while contributing to corporate flexibility and range. The resulting faculty would be capable of dealing with a broad and changing diversity of investigative problems and of sustaining a developing program of instruction. That every such decision does not have this effect is a source of disappointment, but the force of the ideal itself remains primary among academic motivations. To be "the best professor," is a desideratum modified by the aspiration to belong to "the best department" in "the best university"--or to the best that the individual is capable of envisioning.

The importance of this aspect of academic motivation is apparent in its pervasiveness.[6] It functions as an assumption underlying all critical or evalua-

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[6]The following is a "Rate of Faculty Mobility through Ranks," based on actual experience of the academic faculty of The Pennsylvania State University:

	Instructor	Asst. Prof.	Assoc. Prof.	Prof.	Total
1972-73	516	1,025	665	485	2,694
Promotions to next rank	58 (11%)	75 (7%)	55 (8%)		188 (8%)
1973-74	448	1,044	664	519	2,675
Promotions to next rank	65 (14%)	100 (9%)	54 (8%)		219 (10%)

If for illustrative purposes one makes the following assumptions:

1. that the population here described is static (no new appointments at advanced ranks, no resignations, terminations, etc.),
2. that the rate of promotion remains constant from year to year, and
3. that every faculty member wins all possible promotions,

one may compute that the "average" faculty member would spend approximately six years as an instructor, ten years as an assistant professor, and twelve years as an associate professor, or a total of twenty-eight years in which the prospect of possible promotion is more or less in his thoughts. Put another way, approximately 85 percent of a typical university faculty is at all times concerned with promotion as a personal desideratum. For this reason any expression of professional evaluation other than that of promotion suffers some diminution in comparison.

tive judgments. For this reason it must be borne in mind, not as subverting or contradicting systematic evaluation of research, but as posing conditions which must of necessity be met if any such evaluation is to be accomplished.

Example 1: Appointments to "chairs," or "name" professorships

Committees charged with the identification of persons qualified for extraordinary academic distinction are typical of all committees responsible for decisions on matters concerning tenure and promotion. They differ only in the level of their expectations and in the strength of the criticism that ensues when they are considered to have judged incorrectly. The demands they make on candidates are high--as are the rewards which they are empowered to bestow--but the demands are similar to those which determine whether one young assistant professor or another is to be retained by his department and advanced to more complex responsibilities.

For these reasons the selection of individual members of the faculty of The Pennsylvania State University for appointment to the coveted Evan Pugh Professorships may be taken as exemplary of the promotion process as a whole.[7] At the same time, it may serve to indicate the degree to which the sense of value and of quality within an institution is focused in procedures of this sort.

Evan Pugh Professors are appointed by the President of the University upon the recommendation of a selection committee of seven (in 1973-74 there were six) faculty members named by the President. Three members of the committee are drawn from the group already holding the title. The additional members are drawn from the faculty at large.

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[7] This procedure may be regarded as vulnerable to excessive emphasis on intellectual distinction [cf. "The Criteria of Academic Appointment," Minerva IX (1971), pp. 272-90] and apparent depreciation of simple efficiency in useful and necessary work. The degree to which this stricture applies may be judged from ensuing materials.

During the year (1973-74) from which the following illustrative information was derived, four of the University's 519 full professors in active service held the title. In addition to prestige, the title carries with it specific advantages of salary, of direct control over certain specified funds for research, and of a specified budget increment to the incumbent's program or college.

The formally recognized criteria for selection of individuals for recommendation are very briefly and generally stated:

1. The Evan Pugh Professors will be selected without regard for college affiliation or program.
2. The title will be granted only to candidates whose research publications or creative work or both have been of the highest quality over a period of time and, further, to candidates who show evidence of having contributed significantly to the education of students who later achieve recognition for excellence in the candidates' discipline or interdisciplinary area. Candidates must have strong external support from colleagues within their fields.
3. Candidates must have served at Penn State at the rank of full professor.

An indication of ways in which these criteria are elaborated by selection committees appears in a memorandum from the chairman of the 1973-74 committee to academic deans, who with the advice of their promotion committees make initial nominations for these appointments:

> The committee appointed by the President to assist in the selection of Evan Pugh Professorships wishes me to bring to your attention that there has been some unevenness in the quality and completeness of material submitted on behalf of the nominees. In order that all nominees receive fair consideration the committee feels that the information on each nominee should be as complete as possible. The following kinds of information are considered to be a minimum to enable proper evaluation of a nominee:
>
> 1. complete biographical data or up-to-date curriculum vita including educational background, positions held, memberships and services in professional associations and academies, awards and recognition, biographical listings, etc.;
> 2. list of publications, exhibits and/or descriptions of contributions to the creative and performing arts;
> 3. enumeration of services to the University including courses developed and/or taught, major committee service, program development, fund raising effectiveness, etc.;
> 4. precise and lucid descriptions of the unique scholarly contributions the candidate has made in teaching, research, or other creative and professional activities;
> 5. evidence of outstanding teacher-student relationships including teaching evaluations and awards, lists of graduate student degree programs supervised, positions currently held by former graduate students, and other evidences of his or her students' success as scholars and professionals;

6. last and perhaps of greatest importance, evidence that the nominee has a national and international reputation as a scholar. Supporting letters of colleagues at Penn State are beneficial in this regard, but testimonials from scholars at other institutions, foreign and domestic, are needed particularly when they can pinpoint the specific area of work and the precise contribution(s) by which the nominee's distinction is warranted.

A fair number of the dossiers on nominees are quite adequate with regard to the foregoing criteria. I have indicated to you individually below the candidates from your college whose dossiers might profitably be reviewed with respect to the kinds of information needed.[8]

Further elaboration appears in a series of memoranda written by the members of a selection committee in response to the following request:

> It would be very helpful to us if you could spare time to record in memoranda your perceptions of the criteria which were effective in your recent decisions concerning the Evan Pugh appointments. You need not concern yourselves with the individual decisions. In our report it would be inappropriate to deal with personal career histories. But your ideas on how institutions may recognize those individuals who by their talents and energies sustain sound programs of research would be most valuable.[9]

All members of the committee responded, and their memoranda are quoted below. The authors are identified only by their fields of academic identification, and the order in which they are quoted is the order in which they were received:

1. Evan Pugh Professor of Agriculture:

> If the various members of the committee to assist in the selection of additional Evan Pugh Professors respond to your letter, I'm sure you will get a valid perspective of the process. . . . If there was any single limitation in the performance I believe it had to do with doubts about our ability to evaluate scholarly and creative work outside our own individual fields. Some appeared to feel this more strongly than others. This meant that as a committee at times we had to rely on each other and hope that the representation was adequate. Of course one could always argue about adequacy of representation on a small committee.
>
> The task was made somewhat more difficult by the fact that the criteria for the Evan Pugh Professorship were rather vague. As a consequence the dossiers for the thirty-one candidates ranged all the

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[8] Memorandum from Professor Stuart Patton to the academic deans, October 18, 1973.

[9] Memorandum from Henry W. Sams

way from two-page briefs to very elegant in-depth presentations. In order to enable the committee to do a job and in fairness to the nominees the committee sought additional material for many of the candidates. [see memo to academic deans quoted above] . . . . We got virtually every bit of additional information we sought. However, some nominations were very effectively documented and others seemed as though the nominators were simply making a gesture. I am inclined to feel that this is an important variable.

While I feel the committee did a good job, it seems to me that this sort of thing is rather mystical and that people are being guided somewhat by unusual bits of evidence, conceptions, and misconceptions. For example, one nominee received a rather ordinary, one-sentence endorsement from a Nobel Laureate. I pondered that one for a while. One of the committee members expressed the sentiment that the field (for example, a branch of economics) of one of the nominees didn't amount to much. I also pondered that one, the inference being that there are certain academic areas that are just inappropriate to the Evan Pugh Professorship. While there has been some criticism of the final selections for the Professorships in that the arts and humanities are under-represented, I do not feel that this was because the committee found it more difficult to evaluate the candidates from those areas.

Please note that we were a selection committee and in no sense a canvassing committee. Also note that we were asked to assist in the selections, not to make them. I believe this is the first time the faculty was in any way consulted on the appointment of Evan Pugh Professors.

2. Professor of Aerospace Engineering:

Your memo asked for perception of the criteria which were effective in arriving at our recommendations. Personally it was a combination of many factors which influenced my opinion. Briefly, the factors which I considered were:

a. publications in recognized journals,
b. number of Ph.D. and M.S. candidates supervised,
c. external endorsements by personnel outside the University having an obvious standing in the person's field of expertise,
d. activities in professional societies,
e. consulting and public services, and
f. invited lectures.

It is very difficult to say which of the above items I weighed most heavily in arriving at my own personal recommendations. I can only say that it was a feeling which was generated by considering all of these. For example, a person who has only 25 publications as compared to someone with 100 publications over the same period impressed me more than the latter if he had, in addition to his publications, many graduate theses and had been invited to lecture extensively.

3. Professor of Theatre Arts and Director of General Education in the Arts:

Of course we looked over the list of publications and creative work, but we tried to be guided not merely by the quantity, but by the evaluations placed on them by knowledgeable people.

Letters from other scholars also had great weight and we tried to glean from them something of the scope of the candidate's work and the

respect in which he was held by his colleagues. Inevitably, we were probably swayed by the prestige of the source of the letters. In some cases, they came from the top people in the field and literally from around the world.

Since so many of the files represented highly qualified people, I found myself posing a question as to whether this member of the faculty had made a genuine "break-through" in his discipline and of what significance the break-through was. On all these matters we had to rely on the judgments of those who were in a position to know.

I think we were all impressed too with the number and kind of students that a candidate had. For example, when a dozen postgraduate students travel from all parts of the world to spend a year or two studying with one of our faculty, one has to take notice! Some of the files also furnished evidence concerning the success of former students of the candidates.

In cases where I felt I had some minimal competence, I read a sample of the published work, but I must say in many cases this would have been a futile exercise for me.

4. Professor of Surgery:

It was my feeling that an Evan Pugh Professor should be a scholar who has attained national and international recognition by his or her contributions in research. It obviously is at times difficult to substantiate this achievement, especially when dealing with a scholar in another less familiar field. Discussions with acknowledged scholars in other universities is often helpful. The use of the Science Citation Index can be of limited help. Critical review of the scholar's work in first-rate journals also will help.

It is essential to gather as much information as possible from a variety of sources to substantiate the qualifications of the individual under consideration.

5. Evan Pugh Professor of Physics:

The committee members were swamped with twenty pounds of recommendations for more than thirty candidates. I believe we all read these dutifully, and it was not difficult weeding out one-half which sounded somewhat hollow. The consensus between the committee members representing the liberal arts, humanities, and the hard sciences was almost surprising. I believe the colleagues from the former fields held back relatively little in judging scientists, and vice versa, as I did myself.

From paging through the list of accomplishments of a candidate it is usually not too difficult to appraise his creativity, originality, and drive even if one is an outsider. Admittedly, it seems difficult to me, if not impossible, to recognize, say, a mathematician who may have made just one contribution of lasting significance in his speciality. Such a man may go unrewarded, but maybe he does not expect this anyway. My greatest concern were the busybodies, maybe prolific writers of journal articles, and grand contract swingers, possibly on the slick side, who may not be known anymore five years from now when their fads have faded. In between these extremes we find the encouragingly good number of outstanding men who are readily

recognizable without much difficulty, particularly in the hard sciences. Those are people who have founded a school, whose original, easily traceable work is being picked up at tens or hundreds of laboratories, who are repeatedly asked by editors to write review articles in their fields, who are frequently referred to in research papers. In the latter aspect the Scientific Citation Index, with all its known possible biases (see some recent letters to the editor of SCIENCE) is very helpful: If a fellow's papers in respectable, strictly refereed journals are cited by many hundreds of other scientists over the span of the past five years, he must have made an impact on the advance of his field, and most likely not because his subject is just in fashion. In the recommending letters we had a good number of favorable comments by luminosities like department heads and chaired professors. Although weighty, I took them with [pre]-caution, as they surely were from friends and most likely named by the candidates themselves. I suggested a very rough procedure but did not get through with my proposition because of too much work involved and, admittedly, some awkwardness: solicit information about the standing of a candidate some 1,000 miles away from Penn State by writing to a handful of department heads or arbitrarily chosen scientists well known in a field not too far from the candidates'. This is in fact the situation prevailing with the acceptance procedure in firmly refereed journals. The referee is probably not a personal friend and may well be a greedy enemy, but most likely a sober judge.

In summary, while I see local recommendation by department heads or deans as the starting point for the evaluation, the most convincing assurances should come from peers far away if we want to differentiate local talent from nationally and internationally recognized scholars. Originality, creativity, and productivity can also be easily attested by local peers in a group of three or four to balance myopic personal positive or negative biases.

6. Professor of Anthropology:

It is very difficult to catalog or quantify the perceptions of quality for fellow academics. There are, of course, the many very obvious requirements of integrity, originality, etc., but these are somewhat distinct from the measures of outstanding performance which we were searching for in relation to the Evan Pugh awards.

In my own thinking I had a very clear set of expectations but found it somewhat difficult to measure how well individuals met these expectations. In essence, I consider the outstanding accomplishment in academia to be the development of a new direction in the search of knowledge. For example, I would rate the accomplishment of establishing a new and recognized subdiscipline to be a much greater accomplishment than the most thorough of elaborations within a previous existing cognitive framework. The establishment of new directions in the seeking of knowledge may be accomplished by a combination of mechanisms. Obviously, men such as Einstein pioneered whole new areas of thought from little more than published mathematical formulae. On the other hand, some major branches of knowledge have been founded by people who taught but never personally published their own thoughts. I, therefore, searched for those individuals who appear to me to have founded new areas of knowledge, perception, cognition, etc., whether such foundations were laid primarily through scholarly publications, through the production of Ph.D.s, or through a recognition of uniqueness by fellow scholars in the world.

> As you know, I am a great believer in the importance of knowledge quantification, but in this area I found it exceedingly difficult to follow any one or set of production indices.

Careful analysis of these memoranda would yield a list of criteria more complex and particular than that from which the selection committee began its work. In fact, it would be difficult to devise a schematic mode of statement capable of reflecting the differences in emphasis and attitude which distinguish the several responses. Although these differences are in some instances quite marked, they did not prevent the committee from arriving at recommendations which resulted in six new appointments to the Evan Pugh Professorships. These appointments were announced through the campus and the public press by the President of the University. The announcement was separate from, and somewhat more generally newsworthy than, similar announcements of, for example, 188 promotions of faculty rank in the spring of 1973 and 219 promotions in rank in the spring of 1974, but the important point is that the procedures used in selecting the Evan Pugh Professors is characteristic of the evaluative concern of academic institutions.

It is because of the pervasiveness of this concern that faculties tend to respond guardedly when novel, formal, particularized modes of appraising their work are given prominence. They perceive themselves and their institutions as essentially competitive, value-oriented, evaluative agents. Judgment is not only fundamental, it is also constant and unremitting. New procedures, therefore, can function effectively only when they can be seen as supplementing, clarifying, or rendering more just and accurate the complex process by which the academic community itself is identified and organized.

Example 2: Departmental versus Interdisciplinary Interests

The opinion is frequently expressed that an individual's success in winning recognition for his work within a university is influenced by the degree of clarity and exclusiveness with which he maintains his identity with his academic

department. This point of view was forcefully expressed in an address by Sidney Sternberg of RANN (Research Applied to National Needs) at a workshop on "Development of Incentives for Interdisciplinary Research" at the University of Southern California, July 9-10, 1974.[10]

Sternberg contends that "the present system of incentives on campus does not truly satisfy the individual needs of the interdisciplinary researcher. . . ." By "interdisciplinary researcher" he may be interpreted to mean the chemist, physicist, economist, etc., engaged in problem-oriented research in cooperation with others of different professional identification and under administrative auspices other than those of his traditional academic department. The implication is that academic departments adhere so strictly to their disciplines that they regard successful work in a problem-oriented institute, center, or inter-college program as prejudicial to the researcher's claim to recognition in the forms of rank, tenure, and salary.

Sternberg's appraisal of academic incentive systems is accompanied and reinforced by three related points of emphasis:

1. an important test of the validity of research is its usefulness in solving problems of society,
2. solution of problems of society tend characteristically to require multidisciplinary approaches,
3. re-orientation of academic research toward emphases useful to society requires that departmental influences be effectively counter-balanced.

The implication for the faculty member seeking recognition by his peers is that research with colleagues and research under administrative auspices other than his own department is undertaken only at considerable risk. The implication for university administrators is that the interests of research funding may conflict with some established departmental prerogatives.

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[10] See also Robert Straus, "Departments and Disciplines: Stasis and Change," Science 182 (1973): 895-98.

Hard facts supporting or refuting Sternberg's appraisal of departmental attitudes are difficult to isolate. In order to appraise the validity of the question, and to test the feasibility of considering it on a factual basis, career records of 134 faculty members associated with eleven interdisciplinary research institutes and centers at The Pennsylvania State University[10a] were analyzed in the exploratory pattern used with reference to the entire university faculty on page 18 above. The results should be entitled "Rate of Mobility of Interdisciplinary Faculty through Ranks, 1972-1974":

	Instructor	Asst. Prof.	Assoc. Prof.	Prof.	Total
1972-73	3	29	44	56	132
Promotions to next rank	0 (0%)	7 (24%)	4 (9%)		11 (14%)
1973-74	4	23	42	56	125
Promotions to next rank	0 (0%)	2 (8%)	6 (14%)		8 (11%)

From this cursory analysis it would appear that no marked difference exists between the career mobility of faculty members clearly identified with interdisciplinary research and that of the faculty as a whole. At any rate, departmental attitudes should not be assumed to inhibit cooperative research before a thorough analysis of the pertinent facts is available.

[10a] During the years 1972-3 and 1973-4 all persons included in the study held academic rank in the university faculty and were committed to research responsibility in one or more of the following research agencies, with salaries chargeable to these agencies in proportion with the commitments: Applied Research Laboratory, Center for Air Environment Studies, Computation Center, Human Performance Laboratory, Laboratory Animal Resources, Institute for Research on Land and Water Resources, Materials Research Laboratory, Pennsylvania Transportation and Traffic Safety Center, Population Issues Research Office, Space Science and Engineering Laboratory, Animal Behavior Laboratory. The study is based on information supplied by Dr. H. D. Zook, Assistant Vice President for Research and Graduate Studies, and Ray T. Fortunato Assistant Vice President for Personnel Administration, The Pennsylvania State University.

PROPOSALS:

Reliance upon formally established standards of appraisal are natural and frequent in the identification and selection of new "starts" in research, and for this reason the term "proposal" has come into general usage denoting a specific genre of composition, one in which are specified the materials, means, agents, and objectives of a prospective investigative or creative enterprise. Preparation of a proposal usually implies a request for support in the form of budget, facilities, and time. It may be addressed to any persons or agencies capable of providing the desired support. It is, therefore, a request for appraisal--usually in competition with other proposals --with the purpose of winning access to specified resources.

Responsibility for judgment of proposals tends to accrue to those persons who have the capacity to provide appropriate support. The procedures by which this responsibility is met have been shaped by national agencies committed to the organization and funding of research on a very large scale. They are adaptable, however, to intra-institutional circumstances and are used internally when the resources sought are at the university's disposal.

The importance attached to their formal correctness, rhetorical strength, and scholarly soundness by university administrators is reflected in the published university policies summarized in Appendix A.

Both at the university and at the national levels evaluation of a research proposal involves two broad categories of criteria:

1. The first category is derived from the canons of science itself and pertains to the intrinsic quality of the proposal.
2. The second category is derived from the needs and desires of society and pertains to extrinsic consideration such as utility, economic value, or expanded understanding of phenomena.

The dichotomy is expressed in the following memorandum:[11]

> To best satisfy all the requirements inherent in research evaluation, I feel it is essential to have two levels of review. The first is strictly scientific and should be carried out by peer researchers. Some relevant questions to be asked are: Will this research advance the state of our understanding? Is the principal investigator competent to carry out the research? Is the budget appropriate and are the facilities adequate? What

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[11]Memorandum from Herschel W. Leibowitz, Professor of Psychology, The Pennsylvania State University to Henry W. Sams, November 21, 1973.

would be the implications of this research for methodology, theory, technology? What is the principal investigator's past record with respect to utilization of research funds? A large number of questions could be asked. These suggestions are not intended to be exhaustive.

The most important question is: Who does the evaluation? From my experience, the quality of the evaluator is the critical factor in evaluation of research proposals and programs. It is at this point that the Office of the Vice President of Research and Graduate Studies, which by virtue of its interdisciplinary nature, is at a disadvantage. Some investigators do not welcome the broadest possible evaluation of their own programs and if asked might be inclined to choose evaluators who would be expected to be friendly and uncritical. On the other hand, principal investigators are in a position to recommend relevant referees. I would suggest that both the principal investigator and the immediate supervisor, i.e., chairman, director of laboratory or center, etc., be asked to submit names of possible evaluators including, specifically, individuals who are active editors of major journals in that particular field. Since the journal editors are the ultimate arbiters of quality, the availability of these names either as referees themselves or sources of additional referees will automatically tend to broaden the base and competence of the evaluation team. This procedure will undoubtedly involve some paperwork, but there is simply no substitute for evaluation by competent contemporary peer researchers.

There are a number of alternate sources for reviewers. The National Institutes of Health, the National Institute of Mental Health, and the National Science Foundation regularly publish lists of their advisory panels who have been carefully selected for their knowledge of the state-of-the-art. These panels meet regularly, educate each other at review meetings, are continually exposed to the broad spectrum of activity in a given field, and develop internal guidelines which are helpful in predicting the probable success of a research proposal. In addition, the names of the executive secretaries who are familiar not only with current groups, but of past members of boards, are also published. In the absence of any other information, a telephone call to a study section secretary representing a given discipline should be adequate to provide a number of qualified referees. The format for the applicant as well as the evaluators should be standardized, and the possibility of financial compensation for outside referees should be considered.

Following the procedure used by government agencies, a rating of 1.0 is given to an outstanding research proposal which should not be denied. A rating of 2.0 indicates an adequate proposal, while a 3.0 rating predicts that the research will be of some value and could be awarded if funds are available, etc. The numerical value of the ratings should be tied to qualifying statements for the benefit of those not familiar with the system. This method provides a quantitative technique for summarizing and comparing the reactions of different evaluators, and [it] facilitates processing by the administration.

The second level of review should take into account nontechnical factors such as the value of the research to the state and to the national interest, the educational benefits of the program, and other factors which are important in the overall research picture. For example, I have always argued that a higher priority should be given to young investigators who are at a critical stage in their career and for whom the availability of research funds is probably the most important single factor determining their future productivity.

While large sums of federal research support have been available to researchers in mental health and science, our colleagues in the Arts and Humanities have not enjoyed the benefit of support from a generous government. Clearly some priority should be given to those areas within the University community for which the external funding is not generally available. I would believe that this higher order evaluation and priority assignment can be carried out by a committee or board drawn from on-campus personnel. The inclusion of distinguished outside members such as those who serve on the board of the Applied Research Laboratory, distinguished citizens, retired professors and administrators, etc., would obviously be helpful in broadening the base for these critical decisions.

Theoretically, these two levels of consideration are distinct. They are different in the sources of their criteria and in the selection of agents capable of applying the criteria accurately. They are capable of producing mutually contradictory judgments; for example, a particular proposal may be found admirable on intrinsic grounds, but pragmatically infeasible. On the contrary, research of immediate practical value may be deferred or rejected because it does not elicit the distinctive skills of a particular scientist or group of scientists.

Although valid theoretically, the distinction, generally speaking, is not reflected in administrative structures and responsibilities. In the operations of universities, committees are not partitioned in accordance with intrinsic and extrinsic considerations. The two sets of values pertain at all levels, including that of the author of the proposal. Emphases vary with circumstances, but there is no exclusive identification of intrinsic criteria with the bench scientist or of extrinsic criteria with "higher" administrative authority.

This observation is borne out by the fact that when criteria for the appraisal of proposals are formally codified, both intrinsic and extrinsic considerations are present. When research appraisal assumes an official or judicial stance, it simultaneously assumes both orders of responsibility.

Applied Research Laboratory

An example of this combination of concerns is the practice of the Applied Research Laboratory (ARL) of The Pennsylvania State University in the administration of its Exploratory and Foundational (E/F) Research Program, which involves annual

appraisals and ranking of from forty to fifty original proposals and proposals for renewal, with the purpose of funding as many of them as are acceptable and as resources permit--currently about one-half of the total. All proposals derive from inside the University and some are developments, or "spin offs," from the central investigative and developmental programs of the Laboratory itself. Proposals are invited annually. Proposals from engineering, mathematics, and computer science tend to predominate, but projects in biophysics, speech, and speech pathology have been funded, and no area of interests is categorically excluded. Financial support of the Applied Research Laboratory is supplied chiefly by the United States Navy.

The appraisal of proposals is conducted in accordance with a statement of "Method and Criteria" which has evolved since the inception of the program in 1957. Initially the procedure included a review and discussion of all proposals by a panel composed of the executive committee of the Laboratory, the director of the Laboratory, and seven divisional officials, all of whom were qualified by technical knowledge and experience. In practice these dispositions were found to be time-consuming and susceptible to contentiousness, leading to compromise decisions. Increasingly, the responsibility of arriving at an initial rank ordering of all proposals has been delegated to one member of the panel[12] who undertakes from his own point of view to study all proposals and to apply the agreed-upon criteria as equitably as his understanding of the several proposals allows. Consistent with the criterion of pertinence to Naval interests, this reviewer has established communication with the Naval Sea Systems Command. The rank ordering of proposals that he makes after consultation then becomes ground for budgetary decision by the Director of the Laboratory, whose decision, based on appropriate consultation with associates, takes the form of a definition of cut-off point in the ranked list of proposals.

It is typical that the conduct of this program maintains at the operational level of research responsibility a concern for scientific quality on the one hand

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[12]Dr. Miles T. Pigott, Professor of Engineering Research Penn State University.

and for external, mission-oriented interests--in this instance the interests of the United States Navy--on the other. Delegation of detailed decisions to administrative authority within the Laboratory has the effect of reducing the emphasis on advocacy of scientific specialisms and of reinforcing emphasis on quality and relevance. Naturally, the annual publication of decisions on proposals is a matter of general interest throughout the Laboratory and the University. Administrative responsibility is subject to the tolerance of its constituency. It is assumed that the procedure could not long survive the effects of judgments perceived as being in error.

EXHIBIT I.

Method and Criteria Used to Evaluate Research Proposals Submitted to ARL's E/F Program

The evaluation of a research proposal is necessarily subjective. However, unless the evaluating is done systematically, proposals can possibly be scored high or low for wrong reasons, and, moreover, the final score can be a function of the passing mood of the evaluator. In order to insure against these possibilities, a philosophy was adopted, and a method and criteria were formulated to help assure that the E/F program finally drawn would conform to the philosophy.

The adopted procedure is to assign numbers according to how well the proposal meets five different criteria, sum the first four sets of numbers, and multiply the sum by the fifth to get the score. The criteria, the assigned numbers, and the rationale follow.

1. Is there a student who is currently receiving E/F support and who needs to continue into the next fiscal year?

   If yes, 5 points

   If no, 0 points

   Rationale: The research is of value to the sponsor and to ARL only if pursued to a conclusive completion. Also, the support is of most value to Penn State's graduate program if there is continuity and stability for the graduate student. [Renewal of a project beyond a third year, however, would be unusual, the normal and expected period of residence for students seeking an advanced degree being about three years.]

2. Where is the administrative base for the research?

   If external to ARL - 0 points in case no graduate student is identified

   1 point in case a graduate student is identified

proposal rejected if no graduate student participation is intended

If internal to ARL - 3 points in case it is a degree program

1, 2, or 3 points depending on the considered value to ARL and to the principal investigator in case the research does not support a degree program

The research is considered to be internal to ARL if the principal investigator owes more then 50 percent of his administrative allegiance to ARL or if the student is a full-time regular employee.

Rationale: First, there is strong sentiment both with the sponsor and with ARL's staff that high priority should be given to basic research, the need for which has grown from the principally sponsored work. Thus a definite advantage is given to ARL proposals, provided the value of the research is visible in the proposal. Within this criterion, an incentive of 1 point is given to external proposals in which a particular student has been named.

3. Of how much value is the research to the U.S. Navy?

0 to 5 points, depending on judgment. An assignment of 0 is accompanied by rejection of the proposal.

Rationale: Because the U.S. Navy pays for the research, no justification of this criterion need be written.

4. What is the quality of the work proposed?

0 to 5 points, depending on judgment.

Rationale: Adjectives such as significant or trivial, definite or vague, specific or too general, sound or unsound are applied. Criterion #3 needs a check point. A topical area and a proposed problem in general may be of high value to the U.S. Navy, but that is not good unless the approach is sound and the task has been narrowed to something accomplishable in a reasonable time.

5. What is the probability of success?

Sum the points from criteria 1 through 4 and apply a multiplying factor between 0 and 1 to the sum, the factor chosen according to judgment.

Rationale: The conclusive completion of a project requires that the workers be competent and diligent. The competency and diligence of the principal investigator and of his student are considered in light of the degree of difficulty of the proposed task.

An example of the determination of the final score is shown by substitution of typical numbers into a formula.

$$\text{Final score} = \left[\begin{array}{c}\text{points from}\\ \text{criterion}\\ \#1\end{array} + \ldots + \ldots + \begin{array}{c}\text{points from}\\ \text{criterion}\\ \#4\end{array}\right] \times \begin{array}{c}\text{probability}\\ \text{of}\\ \text{success}\end{array}$$

$$= [5 + 1 + 3 + 4] \times 0.6$$

$$= 7.8$$

As it has developed, the procedure has come to embody qualities which give it viability in the University:

1. Research projects are sharply defined.
2. Each is annually reexamined and evaluated.
3. The agents responsible for judgment have immediate knowledge of the technology, persons, and circumstances of all proposals.
4. The provisions designed to maintain equity are persuasive.
5. The program encourages new talent and supports graduate instruction.

The fact that a procedure has proved acceptable to the people who are affected by it is no small item in the question of its worth. Criteria cannot be absolutes. Authority accrues to evaluative procedures through time and on the basis of detailed experience.

Research Initiation Grants, Pennsylvania State University

Parallel with the Exploratory and Foundational awards made by the Applied Research Laboratory is a program administered by the Vice President for Research and Graduate Studies of The Pennsylvania State University and referred to as research initiation grants. Under this program, proposals are invited annually from all colleges and administrative divisions of the University, but with the restriction that all applicants must be faculty members with accumulated service time in the University of less than three years. The primary function of the program is to encourage new faculty members to define and organize their activities in research without delay.

Resources are limited; total funds available for a typical fiscal year are slightly in excess of $100,000. Grants range in magnitude from about $2,000 to about $5,000 for the year. Under the time limitations which apply, renewals are

infrequent. Funds may be used for graduate assistants, travel, wages, and construction of equipment. They may not be used for faculty salaries or for the replacement of faculty members who wish released time from their normal instructional duties, nor may they be used for secretarial salaries.

The initial selection of proposals is made within Penn State's several colleges. Each college is allowed a fixed maximum number of proposals, the number being proportionate with the size of its faculty. The total number of proposals sent forward from the colleges each year is ninety, approximately three times the number which can be funded. The largest college faculty (the Liberal Arts) may submit as many as twenty proposals; the smallest (Business Administration) may submit no more than three. The proposals must be rank ordered within the college before they are submitted for judgment by a University-wide committee.

The selection committee is a subcommittee of the Administrative Committee on Research, a group composed of associate deans for research of all the colleges, directors of research institutes, and the staff of the Office of the Vice President for Research and Graduate Studies. The subcommittee of four or five members is appointed annually from among the members of this group.

The stated criteria by which the subcommittee selects the proposals which are to be funded are as follows:

1. scholarly merit,
2. potential benefits to the investigator and to the University, and
3. contribution (direct or indirect) to the graduate program.

The subcommittee is not enjoined to retain the proportionate distribution among colleges reflected in the quotas of proposals. Nor does the subcommittee undertake to revise the rank ordering of proposals as they are sent forward from the colleges.

The appraisal of competitive proposals within the colleges and their initial rank ordering is accomplished in a variety of ways in the several colleges, but

always with participation of a committee of faculty members elected or otherwise chosen from among the applicants' professional associates. The procedure is, therefore, duplicative of the reviews by professional peers characteristic of the national funding agencies, but it is different in that it is local and immediate. It provides opportunity for the younger faculty member to familiarize himself with the procedures of research budgeting,[13] but with the qualification of access to his judges and of advice and assistance from his colleagues within his department and his college.

"Research initiation" is a phrase of dual significance in that it refers both to the organized support of new research "starts" and to the encouragement and training of neophyte investigators. Continuation of projects begun under this program requires performance which may be judged to qualify the investigator for support from other resources within the University or from outside. This aspect of the program, although the limitations it imposes are stringent, emphasizes a valid point: responsible and continuing research activity cannot be sustained on the basis of local reputation alone. In order to command the resources necessary to his work, including the disposition of his own time, the individual must seek and respect the judgment of his professional peers, whatever their direct and personal relationship, or lack of relationship, with him may be. The necessity for publication, or of otherwise giving effective public currency to finished work, is clear.

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[13]See Exhibit 2, a "Check List for Preliminary Proposals," effected at The Pennsylvania State University on February 8, 1974, pp. 26-33

EXHIBIT 2.

Suggestions for preliminary proposals

(Limited to Preliminary Proposals Not Requiring a University Signature)

Early communication between proposal writers and prospective sponsors is encouraged, including the submission of preliminary proposals not requiring University signature. From time to time problems have emerged in the negotiation of formal grants and contracts because of commitments--intentional or unintentional--made by the faculty member in the submission of a preliminary or informal proposal.

In most situations, observance of the items in the following check list should eliminate or at least minimize the need for substantive changes between the preliminary and formal versions of a proposal.

1. In estimating the budget, include both fringe benefits and indirect costs at the current levels--call the contracts office. Prior approval from the cognizant vice president (continuing education, instruction, or research) must be obtained before other rates are used.

2. It is expected that the budget of a sponsored project will be adequate to cover all direct and indirect costs. For example, salary costs for the principal investigator and other faculty and support staff should be included in amounts commensurate with their time commitments to the project.

3. Both the narrative and the budget sheet (if included) should state that this document is a preliminary proposal which has not been approved by The Pennsylvania State University and that an official proposal will be provided on request. Budgets in summary form are recommended; detailed budgets should be avoided, although they may be an important step for internal planning purposes.

4. Before submitting a preliminary proposal to a foundation, check with the Penn State Foundation office for current information on the foundation of interest to you regarding recent contacts by PSF representatives and other proposals submitted recently.

5. Formal proposals for programs involving long-range commitment of resources by the University must be approved by the President (policy regulations issued July 7, 1972). Preliminary proposals for such programs must also be approved by the President if they exhibit one or more of the following characteristics:

   a. a budget of $1 million or more for the total duration of the proposed program;
   b. the establishment of a center, institute, or laboratory;
   c. the use of University lands;
   d. the establishment of new academic discipline areas or the establishment of new degree programs;
   e. the employment of new tenure track faculty;
   f. the commitment of new monies from the University as matching funds. Advance approval should also be obtained from the cognizant academic administrator before committing matching monies which are part of an existing department, college, or established interdisciplinary unit budget.

6. Informational copies of preliminary proposals for programs in Continuing Education should be sent to the Vice President for Continuing Education.

PROJECTS IN PROGRESS:

It is unusual for universities or their colleges or departments to make formal provision for review of research projects while they are in progress. Exceptions may be found, especially where extensive funding for research is available within the resources of the institution, but the intramural "site visit" is extraordinary.* Informal exchanges of information and advice occur, but except for situations involving illness or palpable delinquency they are neither official nor compulsory. The investigator who does not invite attention to the substantive issues of his work is unlikely to have attention thrust upon him. Apart from the management of his funds, which is strictly supervised, his work in his laboratory or office can be as free from intrusion as he wishes to make it.

This independence extends from the time of funding of the proposal to the time of application for renewal or publication of results. Administrative officers, including deans specifically concerned with research, refrain from surveillance of ongoing projects and from any participation in ongoing projects other than that which justifies itself on the basis of mutual interest and expertise.

Publication or announcement of work in progress--usually with brief designations of research topics, identities of researchers, and sources of funding--serve a roll call function. They are more frequent and more methodical in fields tending toward application, such as agriculture and engineering, than in the more discipline-oriented fields.

External announcement of work in progress also varies from field to field. The Science Information Exchange (SIE), which is based on proposals, provides extensive information on projects funded from governmental sources and within the fields of its coverage. The Current Research Information System (CRIS), maintained by the Department of Agriculture, functions similarly within its fields, but with a more complex system for information retrieval and for updating within the active history of projects. The American Society for Engineering Education annually publishes a comprehensive list of active projects. Researches in education are reported

*See Appendix C on administration of WARF funds at the University of Wisconsin.

through the Educational Research Information Centers (ERIC). In humanistic fields, work in progress is reported on a voluntary basis and with less comprehensive coverage.

Announcements of work in progress do not imply evaluative judgment beyond that of the decision to provide funding, nor do they characteristically provide sufficient detail to support informed judgment. The evaluative criterion they serve is that of redundancy: they can be used to avoid wasteful duplication of work. They may also prompt communication between researchers of complementary interests. But except as indications of general activity throughout a field or a research agency, they have little evaluative significance.

Whether the individual researcher derives comfort or concern from his independence is, to a degree, a matter of temperament. Both responses are justified. It is comfortable for the researcher to work according to his own promptings and without the embarrassment of intrusive surveillance. But the implication of a deferred showdown, in which whatever success or failure may accrue belongs clearly to the investigator himself, is basis for concern also. The showdowns do occur, although not always promptly. They take the form of tangible responses:

a. from competent officials and funding agencies upon application for renewal of support or for support in a new proposal;
b. from editors and referees upon submission of results for publication, citations and reviews, complementary or contradictory publications, professional peers seeking explanation or expansion, and assimilation into developmental programs, practice, or production;
c. from immediate colleagues, explicitly in terms of recommendation for tenure, rank, salary, work schedules, access to working space and equipment, and general supportive interest;
d. from students, as indicated by their attentiveness, quality, prior training and achievement, and by the degree to which their own work develops the distinctive qualities of the work to which they are attracted.

All such responses are subject to delays, some more than others, but it is in these terms that an individual's quality is perceived as moving from promise into performance. The time period involved for any individual cannot be precisely determined, although it is almost always longer than the two- to five-year duration

of the typical project.

Example 1:

Some sense of working under the conditions which pertain may be derived from the following memoranda, which were written by men for whom such conditions have been for several years matter of daily experience. They were written in response to the following request:[14]

> Among the various ways in which individual research projects are considered from time to time and by various agencies, there are none which clearly indicated direct, explicit, evaluative appraisal during the course of the research itself--that is, after the funding of the project and prior to its terminal report.
>
> I refer here to in-house appraisal, but not exclusively to in-house research. I am aware that external funding agencies use site visits, but I am not interested in them just here. What I am after is direct experience with whatever criticism, appraisal, or encouragement the researcher may encounter with regard to his project while it is in progress. I don't expect to find formal procedures or organizations. There is some reason to suppose, however, that informal exchanges of considerable importance do take place--some of them with immediate colleagues and some others with professional colleagues at other institutions.

First Response:[15]

> There are two distinct categories of response to your question. First of all, granting (as opposed to contract) agencies such as NSF, NIH, and NIMH, do not, to my knowledge, engage in any monitoring of research progress whatsoever. They do require an annual report, but as far as I know these are simply filed. Administratively, the people in Washington who receive these reports and with whom the investigator has contact are not qualified to judge their scientific merit. The scientific input must come from the study section members who are already so busy with the current batch of proposals that they would neither have the time nor the inclination to monitor progress reports or engage in any additional interaction.
>
> The only appraisal or scientific interaction would be when the applicant applies for renewal. Renewals must contain a progress report and this is considered very seriously in connection with any request for additional funds. However, once the funds are awarded, there is almost nothing the principal investigator could do which would affect the previously authorized support.

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[14] Memorandum from Henry W. Sams, August 14, 1974.

[15] Memorandum from Herschel W. Leibowitz, Professor of Psychology, The Pennsylvania State University, August 16, 1974.

This procedure contrasts sharply with that of government contract-type agencies. The contract monitor becomes a semi-active participant and not only monitors the research, but in some cases makes scientific inputs which may change the course of the program. In one extreme case, the Behavioral Sciences Laboratory of the Army (BESRL) the monitor is a co-author on papers which result from the projects. It is "as if" the monitor were doing the research himself, but lacking laboratory facilities, these are supplied by the contractee.

The BESRL procedure is somewhat unusual. In general, a contract monitor will simply check on progress, enforce deadlines, and act as a friendly grandfather with respect to the research.

After writing this material, I asked myself whether monitoring of research projects or any other interaction during the course of a grant would be a desirable procedure. My impression is on the negative side. There is already a shortage of personnel to evaluate applications, which is the more critical decision. I also think, in line with government granting policy (NIH, NSF, etc.) that the experimenter should be free to follow new leads which may deviate significantly from the original application. I recall when NIH was first giving grants in the 1950's, this was stated explicitly by the granting agency. I do not know whether it is explicit anymore, but it is certainly understood that the principal investigator is free to change the nature of the program.

In my own study section experience, if we had any reservations about the ability of the principal investigator to carry out a research project, we would reduce the number of years of the award. This requires the principal investigator to reapply and make a formal progress report, so that in effect the program is being monitored.

Second Response:[16]

Thank you for the opportunity to provide input to your report to NSF concerning quality of research. To answer your question as concisely as possible, it would be my impression that in general where principal investigators on research projects are concerned there would not be an explicit evaluative appraisal during the course of the research prior to its termination. Having made that statement, now perhaps I might qualify it with a number of situations with which I am familiar in which a departure from this procedure occurs.

In situations where principal investigators rely heavily on graduate students to perform the research function coincident with their degree requirements, a number of departments require that a formal presentation be made to a selected academic committee concerning the nature of the research, the procedures to be followed, methods of analysis to be employed, and some perception as to the anticipated results from the program. Subsequent to this preliminary proposal meeting, committee meetings may be held during the course of the study (usually at the discretion of the principal investigator) and of course a final meeting is held to evaluate the adequacy of the research.

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[16]Memorandum from Archie J. McDonnell, Professor of Civil Engineering, Institute for Research on Land and Water Resources, The Pennsylvania State University, August 16, 1974.

Although in these situations it is a graduate student making the presentation, he is in many cases acting as a spokesman for the principal investigator, especially if it is an outside-funded research project. The researcher therefore has gained some significant feedback and evaluation during the course of the study. This is a reasonably good approach but one that I understand is not followed by all departments at the University.

In order to evaluate on a timely basis the workings of our own program at the Institute, we make an annual evaluation of the progress of all researchers who are funded through our programs. In this review we look primarily at the researchers' apparent movement toward some prestated research goals. We watch primarily for periods of stagnancy (which can be reflected by lack of publications, lack of proposals in the area of research being studied, lack of inventiveness in identifying new slants to an old problem) but do not necessarily attempt to characterize the quality of the work being performed.

The time for evaluation of research quality usually comes at the termination of a study when a technical completion report is prepared. All studies produced in our research publication series are reviewed by appropriate personnel at the Institute and judgments are made as to the suitability of the reports for publication. Of course subsequent peer review is always given with publication of research results in refereed journals. If one is willing to adopt a fairly long baselength of time for the evaluation of the quality of a research program, then review of published technical reports is a viable method of evaluation even though the research contract may be terminated. Most projects that we interface with are for durations averaging two years. However, at the end of this time, and with the filing of a technical research report, if the sponsors find it adequate to their needs they are usually encouraged to support further studies in the area. To my knowledge no research problem has been solved in one two-year period. I believe NSF functions this way in fact I have heard that 70 percent of their annual research funding goes to continuations of proposals or projects they have funded in the past. With this lengthened timebase, evaluation of the finalized research report can be significant.

In an attempt to promote an evaluation of research efforts during the course of a study, we have at the Water Center adopted a policy that all federal projects funded by us have attached to them liaison representatives from potential user groups such as the state agencies. We require that researchers funded through our federal program meet with these representatives periodically so that a review of the program progress can be maintained. Although this is not necessarily peer group review, it does keep some of our people on a realistic track so that any potentially usable results they may generate can be picked up readily and implemented.

There is a research situation that exists at this University that lends itself very readily to continuing evaluation of research quality prior to termination of a research grant. In all the multidisciplinary projects (those utilizing numerous principal investigators on a research team) that I have been involved with over the years, it has become apparent that the creation of such a team effort automatically dictates a constant evaluation and monitoring of individual researchers' efforts. This is brought about by the fact that interdependencies exist between the individual researchers, in many situations one researcher relying on another's data input; and such interdependencies require that research procedures be explained and documented among the individuals

so that a body of confidence can be developed in the ultimate output. In a recently completed study performed for NSF RANN, the interaction among the individuals was superior, leading to a constant reappraisal of methodologies, a continuing review of data inadequacies and finally a cross-pollination of expertise from various disciplines. If properly handled such team efforts can be extremely rewarding and are most amenable to ongoing evaluation of research quality, since the individual researcher must be constantly on his guard to perform at his best ability.

Example 2: The National Bureau of Standards, Institute for Basic Standards.

The information summarized in this Example was derived from experience in a national laboratory. Its pertinence to intra-university considerations derives from its attractiveness for administrators responsible for large-scale research activities, whether they work in universities or elsewhere. Definitive, commensurate evaluations of research projects and programs are eminently desireable and necessary. But the Example illustrates also the concern, by no means peculiar to academic situations, that through excessive systematization judgment may become Procrustean.

During the spring of 1974 the procedure described below was tested experimentally at the Institute for Basic Standards at Boulder, Colorado, a laboratory of the National Bureau of standards (NBS). It is the product of planning and investigation under the direction of John T. Hall, Chief, Management and Organization Division, National Bureau of Standards, and it is to Dr. Hall that we are indebted for information on the progress of the study.*

The project was initiated and its outlines stated in a draft document entitled "Prospectus for Experiment in Productivity Measurement" (April 11, 1972). From this prospectus it is apparent that in addition to its own concern for accountability in all its operations, the NBS was subject to inquiry from such agencies as the Office of Management and Budget, the General Accounting Office, and the Civil Service Commission. Prior to the institution of this project NBS's response to such inquiries had been that its activities in research and development were not susceptible to measurement. This response, according to the prospectus, was derived

*Completed December 16, 1974: Productivity Measurement in R & D A Report on a Productivity Experiment (PROMEX) in Selected Research and Development Programs at the National Bureau of Standards.

intuitively from what we assume would be the results of any attempt to measure our products" and appears for the time to have been accepted, "though reluctantly."

The investigation was begun with the understanding that no satisfactory system for measuring the productivity of research programs had previously been developed and that "application of methods for determination of research activity is quite different from that used for more conventional activities" (Prospectus, p. 6). More specifically, the proposed system should:

1. take cognizance of qualitative and subject[ive] elements of the work,
2. consider social and economic impact of the work as well as its technical quality,
3. establish objectives and schedule milestones against which results may be appraised, and
4. provide a technique for evaluating and normalizing the measurements themselves.

The subjects of the experiment were to be research programs (collections of research projects) within the operations of the NBS and would be restricted, for reasons of time and staff, to a maximum of eight programs. However, for purpose of testing the evaluation procedure, all twenty-eight programs in the five divisions of the laboratory at Boulder were included. The chiefs of the five technical divisions of the laboratory at Boulder participated actively in the development of the criteria and procedures for evaluation which were to be applied to the programs under their supervision. Their active cooperation, and that of their staffs, was an essential condition of the experiment.

The division chiefs are themselves technical experts, generally familiar with each of the program areas and accustomed to the formal and informal accretion of value judgments with respect to research in their own divisions.

The situation which emerged in the course of the experiment was novel, however, in that, with the director of the laboratory, all five of the divisional chiefs were involved in formal evaluation of each other's as well as of their own programs.

The review applied to programs in progress on a continuing basis. Projects still in proposal stage and others complete or nearing completion might enter into the examination, but the central focus was on activities whose outcomes were as yet unknown and in which problems remained as problems. The review was therefore comparable in timing with that which occurs when investigators propose renewal or extension of projects approaching the end of their initially defined terms. Concern for this emphasis and focus is apparent in the nature of the concise set of criteria devised for the evaluation. The criteria are here quoted in the form[17] in which they were initially and experimentally applied.

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[17] See Exhibit 3, pp. 46. This form remains unmodified in the final report.

EXHIBIT 3.

Criteria for Evaluation: Value Analysis

Program _____

Presenter _____

Rater _____

	None	Low	Medium	High	Very High
1. RELEVANCE TO NATIONAL NEEDS					
a. Primary legislative responsibility: Does the program promote national capability for physical measurements to the accuracy or precision needed?					
b. National goals and needs of society: Are the significance and urgency of the problems addressed great in terms of their impact on the nation?					
c. Payoff: Are the anticipated outputs significantly greater than anticipated inputs?					
d. Leverage: Can NBS have a unique and substantial impact on the problem? Who is waiting for the results? What will they mean to him?					
2. INSTITUTIONAL HEALTH					
a. Probability of success: Is the problem well analyzed? Does past performance point toward success? To what extent is the field ripe for exploration?					
b. Resources: Do the funds, leadership, and technical capabilities exist to support such a research effort?					
c. Technical merit: What is the technical quality of the output? Does the program enhance NBS stature? Does the program draw from or contribute to other fields?					
d. Staff welfare: Is there opportunity for desirable individual growth? Development of new skills? Opportunity for scientific contribution?					
3. Rate the quality of the presentation:					
4. Rate the extent to which the quality of the presentation may have effected your evaluation:					
5. Rate your technical knowledge of the field or program area covered in the presentation:					

The procedure used was that of oral presentation by first-line supervisors addressed to NBS's executive board and other officials, including the five divisions chiefs and the director of the laboratory. Supervisors had been informed of their responsibilitiy to make the presentations eight to ten weeks prior to the time at which they were scheduled. Some statistical handouts were prepared, as were such aids as slides, flip-charts, and other exhibits. Approximately twenty minutes were scheduled for each presentation, with time for questioning afterward.

The seven members of the reviewing panel marked the form independently, and the results were tabulated. No weighting scheme was used. Several plausible weighting schemes were tentatively applied to the data after they were tabulated, but no significant change in the general ranking of programs occurred because of the different schemes. At the present stage of the investigation, it appears unlikely that weighting will prove useful.

Although this particular application of the reviewing procedure was explicitly intended to test the means of measurement and not to measure the programs themselves, the experimental results prompted an immediate revision of organization within the laboratory, including the actual closing out of some activities. In this instance, at any rate, the people in the programs proved attentive to the results of their own review. The response suggests that the people immediately involved perceived the review procedure as having validity.

Responsible administrators of research in a university situation proved, when questioned about the Boulder experiment, to be less sanguine. They invited attention to the following qualifying circumstances:

1. The Boulder review involved components of a total research program funded under a single annual appropriation. The characteristic research program of a university, or of one of its colleges, is an amalgam of projects individually funded and budgeted, and capable of great diversity.
2. Interrelationships among persons, from bench scientist to director, in a laboratory like that at Boulder are of a line and staff order, with a specific sense of common mission in research. In a university the hierarchy of research authority is related primarily to intellectual

disciplines and only secondarily to particular investigative missions. This difference arises from the commitment of the university to instruction.[18]

The importance which in a university may be attached to these distinctions is apparent in the following paragraph from a memorandum (June 5, 1974) written by Maurice E. Bell, Associate Dean for Research in the College of Earth and Mineral Sciences, The Pennsylvania State University:

> . . . the most important purposes of academic research are to create new knowledge to be used in teaching students and to insure that the teacher is abreast of the developments in his field; to increase the eminence both of the individual faculty member and the institution as a whole and thus to attract the most promising students and to instruct them with authority; to provide the background and competence whereby faculty members may speak with authority in public affairs and contribute substantially to the solution of public problems; and to provide thesis topics and financial support for graduate students, which the University, because of its meager financial support from the state for this purpose, is unable to provide. All of these activities are enhanced to the extent that the University creates and maintains a strong, free, and independent faculty who are capable of initiative in each of their activities and of self-evaluation of their accomplishment. It is precisely these characteristics which would be damaged most by close supervision of the faculty by representatives of the University administration, or by direction of their research from above, or by superficial evaluation of the results by persons whom the faculty do not feel to be qualified for this function.

Similarly Paul Ebaugh, Associate Dean for Research in the College of Engineering, The Pennsylvania State University, asks: "Why are we interested in criteria? Would every research project be subject to such a check-off?" In a second memorandum (June 5, 1974), he says:

> The research mission of a university is much more diffuse and covers a vastly greater spectrum of disciplines [than that at Boulder]. Briefly, it is to analyze and build upon (or add to) all aspects of human knowledge. Because of this breadth, it is impossible to gather together a review team capable of objectively reviewing and criticizing the scholarly pursuits of

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[18]To these observations Dr. Hall responded as follows (memorandum of July 19, 1974): "I would like to point out a misunderstanding about the nature of our Boulder programs . . . . The Boulder components covered in the review do not represent a total research program funded under a single annual appropriation. In fact the Boulder programs are diversified and are dependent upon approximately twenty-five different sources of funding. Also. . .one of the critical management problems at Boulder stems from the lack of a sense of common mission in research with a wide range covered from basic research in the Laboratory Astrophysics Division, which is part of the Joint Institute of Laboratory Astrophysics with the University of Colorado, to calibrations service in the Electromagnetics Division."

all its professors.[19] Certainly no single set of criteria can be established which will determine the usefulness of all research projects, basic and applied.

Both of these responses refer to the implication of a uniform application of evaluative criteria to an entire university or to an entire college such as the two which their authors represent, both of which are actively engaged in extensive and diverse research activities. Exceptional situations within a university may invite codified criteria. As Dean Ebaugh observes, ". . . the Boulder Laboratory criteria are not unlike those used by the Office of the Vice President for Research and Graduate Studies in considering new centers, institutes, or laboratories of an intercollegiate nature. . . ."

Thus a specific instance of formal research evaluation appears to have been at least initially acceptable and effective for a group of a scientists in one situation, but quite unacceptable to scientists of comparable probity in another. Dean Bell concludes that "those who would not care to accommodate their research careers to the whims of the institution and to the national goals and needs of society as perceived by the university administration would go elsewhere if they could."

What success the Boulder experiment may have with those outside the National Bureau of Standards who would monitor the Bureau's research, whether through the proposed procedures a less reluctant acceptance may be won, remains, of course, to be seen. Viewed as a paradigm of formal research evaluation, the Boulder experiment illustrates the interplay of pressures and sanctions which through various means apply to organized research, whatever the situation in which it is undertaken. The principal ground of agreement, on which no differences appear, is that whatever errors of judgment or procedure may tend to dilute or deter the advancement of knowledge should be isolated and corrected. The perception of what errors of this kind are most to be feared varies with differing points of view.

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[19]To this observation Dr. Hall responded as follows (memorandum of July 19, 1974): "I think the assertion that it is impossible to gather a review team capable of objectively reviewing scholarly research pursuits would prove false in the event of a competent trial."

PROGRAMS:

Beyond the appraisal of individual persons and proposals, the scale on which organized evaluative procedures have been most frequently undertaken within universities is that of the program. Used in this sense, program denotes a cluster of related instructional and/or research activities drawn together by common intellectual and professional interests and established with some degree of administrative autonomy. It may correspond with a department; it may occur within a department; and it may consist inter-departmentally or inter-collegially of elements from a number of departments. It is overt in the sense of the Greek term from which it derives--a public announcement in writing. Its integrity is usually recognized in institutional budgets.

An intensification of internal evaluation has taken place in American universities quite recently,[20] and it has been focused on programs. A number of reasons why this emphasis has occurred may be speculatively offered:

1. The scope of program review does not greatly exceed that of technical understanding which may be expected of a responsible administrative officer.
2. Program review corresponds roughly with the familiar patterns of accreditation by professional associations and their agencies and with the continuing self-appraisals of disciplinary departments.

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[20]For examples see:

a. Budgeting and Resource Allocations at Princeton University, Report of a Demonstration Project Supported by the Ford Foundation, June 1972.

b. Harold W. Hake, "Council on Program Evaluation (COPE) Explained," Campus Report, Office of the Chancellor, University of Illinois at Urbana-Champaign, Vol. 7, No. 6, March 1974.

c. "Five-Year Review of Graduate Programs," with memorandum (August 20, 1971) from Michael J. Pelczar, Jr., Vice President for Graduate Studies and Research, University of Maryland, College Park, Maryland.

d. "Policy and Procedure for Review of Graduate Degree Programs," with memorandum (August 23, 1971) from Frank Johnson, Dean of the Graduate School, University of Utah, Salt Lake City, Utah.

e. "Accountability and Educational Criteria: University Planning for Selective Growth," with memorandum (July 22, 1971) from Malcolm Moos, President, University of Minnesota, Minneapolis, Minnesota.

f. Comparable developments in Canada are reflected in The First Three Years of Appraisal of Graduate Programs. Ontario Council on Graduate Studies, Toronto 1970.

3. It corresponds with fiscal categories closely enough to permit practicable recommendations of constructive economies and reallocations of resources.

4. It permits consideration of instructional and research objectives without prejudice to either and with understanding of relationships between the two.

5. It does not necessarily come into direct conflict with, at the one extreme, career decisions affecting individuals and, at the other extreme, with broadly conceived institutional policies.

6. It is informed by and supplements the provisions for evaluation of science and scientific manpower afforded by national agencies.

These reasons--and others might be suggested--have led to a proliferation of organized reviews of programs at a number of universities and elsewhere on a state- or system-wide basis, most markedly during recent years when the necessity for institutions to accommodate their development to level or diminishing resources has become increasingly apparent.

The purpose of program review is to support informed decisions on the question of what institutional commitments should be entered into or reinforced, and by this means to improve institutional value.

Stated in the broadest terms, the criteria upon which such decisions are based are of three kinds:

1. the program's intrinsic quality, its intellectual integrity, accuracy, and productivity;

2. its relationships with adjacent programs and contribution to the parent institution as a whole; and

3. its utility and effectiveness for society at large.

Specification of these generalized criteria to particular programs produces considerable variation of phraseology and emphasis, as well as sharp differences in the relative importance assigned to the three general areas of concern. Insofar as program review can obviate confusions of this sort and produce an institutional capacity for self-criticism, it will have met the expectations which appear to have led to its institution and to the remarkable investment of labor and thought which

university faculties and administrations, as well as governmental agencies, have made in it.

Characteristic of program review wherever it has been used as a formal procedure is its involvement of critical points of view related to but removed from those of the program itself. If the "peer group" is defined as consisting of persons of professional and disciplinary character identical with that toward which the program is directed, then program review is not exclusively a "peer group" review. The critical view may be typified as that of "related fields," "cooperating programs," or "academic neighbors." It is a "user's" point of view, but with technical understanding lower by a single magnitude than that which the program itself professes. Such review cannot analyze proposals emanating from a program with the thoroughness expected of competent peer group teams. This is a deficiency only in the sense that it restrains program review committees from undertaking to duplicate or replace the functions of specialized peer group review.

The individual researcher whose program is under review does not confront expert and detailed analysis of his work. He does confront competent appraisal of the impact of the program with which he is identified upon its appropriate community, locally and nationally defined, and of his particular contribution to it.

This aspect of program review is affected by the emphasis placed in any particular institution upon the employment of reviewers who are not members of the institutional faculty. "Internal review" is thought of as depending primarily upon judgments derived from persons in related fields within the institution. "External review" requires the enlistment of authoritative opinion from off campus. The advantages and disadvantages of both emphases are extensively debated, but there appears to be no ground on which either can be preferred to the exclusion of the other. The result uniformly has been compromise. In general, compromise has not taken the form of mixing internal and external participants in a single review team, but of using internal and external teams to inform, correct, and counterbalance one another.

Review procedures have been organized at some institutions on an administrative base. At others they are established by the authority of the faculties themselves. Here again there has been extensive debate resulting in compromise. The functions implicit in program review involve all elements of a university, and individual responsibilities, whether they be administrative or otherwise, are accentuated by its effects.

Example 1 cited below incorporates provision for location of authority, appropriate agencies, and broad criteria applicable to the entire range of the university activities. It pertains to organizational provisions only, not to operational performance.

By way of explanation, the Graduate Council of The Pennsylvania State University is an elected body of forty-four members (including five graduate students) which represents the Graduate Faculty of approximately 1,600 members. Chaired by the Dean of the Graduate School, the Council acts on behalf of the Graduate Faculty as a whole and subject to its approval. The recommendations quoted below were adopted by the Graduate Council on May 2, 1973, and reviewing subcommittees were first convened in January 1974.

Example 2 consists of criteria suggested by a university official with central administrative responsibility for nineteen interdisciplinary research programs. Its applicability extends to any organized academic program in which research is an important factor.

Example 1: Procedure for Continuing Review and Evaluation of Graduate Programs

The following procedures were recommended to the Graduate Council of The Pennsylvania State University in response to an action of the Council at its meeting on January 17, 1973. By that action an ad hoc committee was formed, and charged as follows:

In keeping with the goals of the University and those of the Graduate School:

1. prepare a plan for program review; and

2. prepare a phasing scheme for implementation of the plan if this is felt to be necessary.

The report which follows consists of the following parts:

1. principles and purposes;

2. a definition of agencies;

3. procedural rules and schedules;

4. suggested criteria;

5. recommended guidelines for program profiles.

1. Principles and purposes:

   a. A condition of effectively maintaining and developing a graduate school of professional quality is a continuous monitoring of individual programs.

   b. Such monitoring requires competence appropriate to the programs under review, including the competencies of related departments and the Graduate Faculty as a whole.

   c. While consultation with agencies external to the Graduate School and to the University will frequently prove desirable and at times necessary, the fundamental responsibility for judgment is internal to the Graduate Faculty.

   d. Adjustment of academic judgments to fiscal necessities will remain a responsibility of the academic deans and for this reason program evaluation in the Graduate Faculty, insofar as it affects fiscal dispostions, will be an advisory function.

   e. As an advisory function, program evaluation will be public in the sense that it will at all points be conducted with the full knowledge of and participation by the agencies under examination, including the cognizant deans and directors, and it will be controlled by recognized rules and criteria.

   f. Review procedures will be sufficiently flexible to permit address either to single programs or to combinations of programs from more departments, colleges, or other administrative groupings than one.

2. A definition of agencies:

   a. The key reviewing agencies will be program subcommittees convened by the Dean's Administrative Committee for Program Review (to be described below) and consisting of members selected as follows:

(1) one representative of the Dean of the Graduate School;

(2) one representative of the dean or director responsible for the program under review; this representative may not be a member of the faculty under review; where more than one dean or director is cognizant each will designate a representative; and

(3) representatives of the graduate faculties of from two to five related fields as selected by the Dean's Administrative Committee in consultation with the persons in charge of the program or programs under review and with the approval of the cognizant dean.

b. Program subcommittees will report to the Standing Committee on Programs and Courses with copies to the cognizant deans.

c. Program subcommittees will have staff support from the Office of the Dean of the Graduate School, from the programs under review, and from the cognizant deans.

d. The Dean's Administrative Committee for Program Review will consist of the following persons:

(1) the Associate Dean for Program Review;

(2) the chairman of the Standing Committee on Committees and Procedures;

(3) the chairman of the Standing Committee on Academic Standards; and

(4) the chairman of the Standing Committee on Programs and Courses.

e. The Standing Committee on Programs and Courses will receive the reports of the program subcommittees, discuss the full report with the cognizant deans, and, with or without endorsement, convey the reports to the Graduate Council.

3. Procedural rules and schedules:

a. Reviews of existing programs will be instituted by the Dean's Administrative Committee for Program Review in accordance with:

(1) a rotating schedule which includes all graduate programs within a five-year period:

(2) recommendation by the Dean of the Graduate School when the Standing Committee on Academic Standards concurs that such recommendations are justified; and

(3) the conditions which will occasion minimum duplication of effort on the part of faculties, deans, and directors of programs who may from time to time be responsible to other reviewing agencies.

b. For the purposes of review, "existing programs" will be understood as programs which have had at least five years of experience subsequent to their authorization.

c. Program subcommittees will normally be active for the period of one term, but will be identified and announced to the Graduate Council with one term of preparatory lead time.

d. Program subcommittees will be informed as indicated in item 5 below through:

(1) information prepared by the Office of the Dean of the Graduate School;

(2) information supplied by the person in charge and the dean or director of the program under review;

(3) information from members of the faculty, students, and graduates, through scheduled meetings, correspondence, and consultation subject only to the restraints of fair and responsible procedure and the legitimacy of evidence;

(4) reports of external accrediting teams when such reports are regularly received and can be made available by the Dean; and

(5) appraisals by qualified specialists at other institutions when in the judgment of the cognizant deans, the Dean's Administrative Committee, and the program subcommittee such appraisals are found indispensable. In general, it will be assumed that consultation with specialists outside the University should be reserved for situations of appeal, when cognizant deans dissent from the reports of program subcommittees.

e. Reports of Evaluating team will consist of

(1) a full report of program evaluation including all descriptive and other data;

(2) a statement of recommendations in two categories (a) those essential to the future improvement of the program, (b) those helpful but not necessarily critical to program improvement;

(3) the Evaluating team should rate the program as superior, strong, reasonably good, average, weak, or however its judgment dictates relative to specific standards and explanations contained in its report.

f. Based upon the report of the Evaluating team, the Standing Subcommittee on Program and Course Review and Evaluation will make a recommendation to the Graduate Council, through the Committee on Program and Courses, about the future of the program in terms of its quality, and/or the importance of its contribution to the University's mission.

g. When discussion of reports by the Standing Committee on Programs and Courses and the cognizant deans results in additional information or comment, the additional material will be appended to the report with indication of its source.

h. When the cognizant dean elects to dissent from the report of the program subcommittee, the full report, with addenda, will be submitted to the Graduate Council by the Standing Committee on Programs and Courses. When there is no dissent, the summary report only will be submitted to the Graduate Council.

4. Suggested criteria:

a. The quality of the faculty and of the program of graduate instruction, as they can be inferred from the record of productivity in the field, the views of faculty members in related disciplines, and any available evidence based on the opinions and experiences of graduate students

b. The number and quality of students who have applied for graduate study in the field, who have accepted admission, who are enrolled, and who have completed the program.

c. The national contribution of programs, viewed in the context of other strong programs, whether or not they are operating at their desirable size, and, in general, whether suspension or curtailment of a program would have a seriously adverse effect on opportunities for graduate study generally.

d. The comparative advantage of Penn State in the field--that is, the ability of Penn State to make a particular contribution to the field in question because of special factors such as long tradition of good work in the subject, unusually strong library or laboratory facilities, advantageous relationships with agencies of education, industry, government, etc. external to the University, and so on.

e. The interactions between graduate study in the field in question and graduate work and scholarship in other fields at Penn State, and the likely effects of curtailing work in the field on other programs, faculty members, and students.

f. The interaction between graduate study in the field and the quality and variety of undergraduate offerings in the same and related fields.

g. The costliness of work in the field, measured in terms of instructiona costs, student support, library costs, space costs, and so on.

5. Recommended guidelines for program profiles are:[21]

a. Program sheets from Graduate School Term Reports from Summer 1972 onward including:

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[21]Items a, b, c, and part of d can be routinely supplied by the Graduate School.

(1) names of graduate students enrolled term by term;

(2) their credit status;

(3) the types of appointments which they hold; and

(4) their payroll budgets indicated by number.

b. Titles of theses and dissertations from 1970 onward, with names of preceptors, and with reports of readers when such reports are available.

c. Names of recipients of doctorates since 1965 and the information which is available on their subsequent careers.

d. Faculty involved (total and FTE).

e. Faculty strength:

(1) publications and/or other indications of professional productivity;

(2) textbooks and popular articles;

(3) professional societies: officerships, awards;

(4) consultantships; paid and public service; and

(5) honors and special achievements.

f. Research support for the faculty, prorated to FTE involvement:

(1) from external sources; and

(2) from internal University sources.

g. Maturity and development of the program:

(1) number and location of other comparable programs;

(2) subfields within the program;

(3) related, supporting, and dependent programs within the University;

(4) summary of courses offered within the program with enrollment histories; and

(5) summary of course changes, additions, and deletions through the past ten years.

Example 2: Some Criteria for the Evaluation of Organized Research Programs[22]

The memorandum quoted below reflect the experience of an academic administrator responsible for a number of programs oriented primarily to research. (See above, p. 27, note 10a) Responsibility of this kind includes the preparation, negotiation, and modification of budgets, and thus implies a degree of control over the disposition of institutional resources. Such offices are appropriately termed administrative, rather than managerial, for they do not confer authority to cancel or curtail commitments previously entered into or to infringe upon adjacent programs. Their influence is effective in the redisposition of whatever fraction of total pertinent resources may at any time become disengaged, in the application of efforts to acquire new resources, and in the adjustment of activities to diminishing resources. The relationship between Example 1 above, and Example 2 cited here parallels the relationship between an academic governing body, in this instance the Council of a Graduate Faculty, and a responsible administrative officer.

As promised some time ago, I agreed to list my personal criteria for the evaluation of organized research in a university. I do so with some knowledge of the risks involved and an awareness that several of the ideas are unpopular in certain parts of the University. However, only when individuals are willing to reveal, list, define, discuss and collate their "prejudices," can we arrive at a working set of standards to satisfy the current need. Surely such a set of criteria each with a brief rationale would go far to assure an evenhanded appraisal of organized research not only by an evaluating committee but by the person or persons who must finally make budgetary decisions.

It is desirable to distinguish the criteria to be applied to a program from those that might be used to evaluate the research per se or the researchers. The latter are more likely to be subjective and are best applied in a peer group evaluation as suggested by Professor Liebowitz (pp. 29-30)

The following list has no priority order:

1. Contribution to the Graduate Program of the University
   (a) Number of terms of graduate students support each year and dollar value of stipends, grants-in-aid for graduate students.
   (b) Number of graduate students for whom the faculty in the research of program serve as advisors or committee chairmen. Number of faculty members serving on graduate student committees. Student-credit-hours generated by faculty in 600 courses.
   (c) List of graduate students receiving direct aid from the program's resources-supplies, equipment, travel and other research expenses. Dollar value of this contribution to the graduate program.
   (d) List of theses completed over the past five years by graduate students supported by the program. List of publications based on these theses.

[22] Memorandum from H. D. Zook, Professor of Chemistry and Director of Intercollege Research Programs and Facilities, The Pennsylvania State University, April 3, 1973.

A matrix of the above parameters shows at a glance the involvement of the faculty in the graduate programs of the University. A dollar value can be assigned to (b) and when added to those in (a) and (c) can be used to determine the percentage of the research program's resources devoted to graduate studies. If the percentage is low, the University's sponsorship of the program must be justified on some other basis.

2. Composition of Program Personnel

   (a) Number and full-time-equivalents (FTE) of faculty with professorial ranks (tenure-track).

   (b) List of postdoctoral term appointees including the disciplines and universities granting the degrees.

   (c) Number of "permanent" faculty appointees in the research ranks.

   (d) Number of staff, clerical and technical service personnel.

   The composition of the program personnel will indicate the extent of autonomy of the unit. A de-emphasis of professorial faculty indicates a tendency to drift away from the academic community and to build a full-time professional staff, possibly to fulfill commitments to programs of outside sponsors. The post-doctoral fellow with an excellent background is invaluable in the training of graduate students and frequently necessary to maintain quality and quantity of research accomplishment. Also, a reasonable ratio of staff support, clerical, etc., is easily justified. However, a large fraction of resources devoted to (b), (c) and (d) would suggest that the program might be separated from the University without detrimental effect.

3. Societal Demand and Program Uniqueness

   (a) List of similar programs at the fifty leading research universities. Faculty size and brief description of each can sometimes be obtained from university catalogs.

   (b) List of employers and description of positions accepted by graduates over the past five years.

   (c) Research funding at the national and state levels for research appropriate to the program. List of agencies and amount of funding (from published budgets or expenditures).

   (d) Fraction of the potential funding awarded on an annual basis to the Penn State Program. List of awards, agency, principal investigator and amounts.

   There is always the question whether a university should tailor its programs to available funding and usually a compromise must be reached. A program for which major funding is available (c) will soon experience keen competition (a) and then must be judged on how well it can attract the available funding (d). A program for which little or no outside funding

is available will likely be unique with little competition from other universities. Justification for University funding will depend on unique research experience (b).

4. Quality of the Research (Researchers)

   (a) List of publications in well-recognized national or international periodicals with peer review or in books by well-established publishing houses.

   (b) A rating of each of the above publications based on the amount of substantive material that is novel. (Is there a significant addition to the store of knowledge or theory in contrast to little new knowledge, much verbiage and promise of research to come?)

   (c) Evidence of favorable citations in publications by peers.

   (d) Honors, awards and citations of individual researchers including sabbatical leaves and how they were spent.

   Although the evaluation of research quality is largely subjective and best made by peer review, a fair impression can be gained by the non-expert from this reasonably objective material (a-d) if sufficient time is devoted to the reading (in contrast to counting) of the published research.

5. Viability of the Program

   (a) List of seminars, workshops, and conferences in which the faculty and students participated <u>as a group</u>.

   (b) List of proposals submitted jointly by more than one faculty member.

   (c) List of publications with joint or multiple faculty authorship.

   (d) Description of shared space, equipment and other facilities, particularly to provide faculty interaction and opportunity for graduate students to interact with other faculty and students.

   (e) List of grants and contracts including sources and amounts of non-university research support that is believed to depend on the existence of the program in contrast to the individual faculty members.

   (f) An assessment of cooperative spirit, morale and leadership.

   This material should provide justification for the organization of the particular individuals. What is gained by their interaction? Do they indeed interact?

6. Centrality to the Purposes or Mission of the University

   (a) Statement of program objectives.

   (b) Are the activities in accord with the objectives?

   (c) Is the program of a peripheral nature upon which little other research or instruction depends?

Two addresses to the review of programs have been cited:

1. A set of procedures by which a faculty proposes to maintain systematic and continuing examination of its own activities.

2. A set of criteria by which a responsible administrative officer undertakes to evaluate the activities with which he is concerned.

The two differ markedly. However, their differences do not imply conflict. On the contrary, the efforts of academic officials to arrive at well-informed judgments find appropriate alliance in dispositions of faculty to consider problems of institutional proportion, balance, and emphasis. A number of universities (See note 20, page 50 above) have demonstrated regard for the academic program as defining the unitary scale on which these two perspectives can be brought to bear cooperatively and effectively. Program review is at any rate the frontier on which advances are being made. The success with which it can be sustained over long periods of time and through changes in the societal climate for education and research remains to be seen, as does its capacity for disruptive judgments. However, it involves the professional populations who have the competency to make the necessary judgments. They have accepted the involvement. This is apparently the most promising direction in which to seek improvement.

ETHICAL CRITERIA:

Research frequently involves faculty members in relationships external to the university and with agencies whose purposes are different from those of the university. For this reason many of the universities committed to organized research have found it necessary to define standards of conduct appropriate in these relationships[23] and to establish procedures by which these standards can be made effective. Typical among the several formulations of general principles of this kind is a pamphlet entitled Report of the Committee on Criteria for Acceptance of Sponsored Research in the Faculty of Arts and Sciences, Harvard University 1970. The Harvard report proposes six "Principles" which serve to define the area of ethical concern. They are as follows:

1. Any research agreement between the University and an external sponsor must have obtained some form of sanction in advance. The purpose of this sanction is to insure that the research conforms to the administrative and fiscal policies of the University, and to the present principles, and that it does not conflict with the rights of other scholars in the University, nor with other University commitments.

2. The sources of sponsorship and the purpose of the research must be of such a nature that they can be publicly disclosed.

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[23] a. Princeton University, "Policies for Sponsored Research" in Rules and Procedures of the Faculty. Princeton, New Jersey, April 26, 1960; revised October 1971.

b. North Carolina State University. Research Policy. Raleigh, North Carolina; Office of Information Services, April 15, 1972.

c. University of Minnesota. Principal Investigator's Manual. Minneapolis, Minnesota; Office of Sponsored Programs, September 1972.

d. Michigan State University. Sponsored University Programs for Research and Education. East Lansing; Office of Research Development and the Graduate School, Publications No. 12 1971.

e. University of Massachusetts. Manual for Sponsored Projects. Amherst, Massachusetts; The Graduate School, October 6, 1972.

3. The University will not undertake to grant any special or exclusive information to a research sponsor, nor will it accept research which carries security classification, requires security clearance of University personnel, or otherwise precludes general publication of results.

4. All research projects must be undertaken with the clear understanding that the investigators concerned have the full right to publish any results obtained by them, subject only to established safeguards for the protection of privacy or confidentiality of personal data.

5. Any results obtained and any papers published or lectures given by investigators on research projects are the sole responsibility of the investigator concerned, and Harvard provides no institutional endorsement of the work or of the sponsor.

6. All research on living animals and on human subjects should follow the safeguards established by the University for such work.

In the Report each of these summary statements is developed in a paragraph or more of illustration and discussion. Similar illustrations and discussions have been developed in a considerable and growing body of literature and in the agenda of faculties and of professional associations. Parallel with this discussion, and emerging from it, have been new regulations and organizational structures designed to meet the problems which have arisen and to hold research to conformity with appropriate values and standards. Some areas of ethical concern have proved amenable to university-wide administration and to regulation through agencies of state and national government. No other administrative functions exclusively focused on research are at the present time more explicitly organized and established in the universities than those which arise from ethical considerations. In fact, no better way to understand the ethical aspects of research appraisal presents itself than that of surveying the offices in which responsibility of this kind is vested on university campuses. It is unlikely, of course, that any two universities would have identical administrative structures for these purposes, but the delegations of specified responsibility reflected in the following enumeration may be regarded as typical. This enumeration is made without regard for the overall hierarchy of university administration.

Contract Negotiation

In order to assist authors of proposals, particularly with respect to the preparation of their budgets, to protect the university against commitments which intrude upon or contravene its overall mission, and to assure sponsors that their requirements are fully taken account of, universities maintain central control of all contracts with external agencies. Offices designed to serve this function are strictly regularized and given full authority within defined limits.

A recognized device by which the demands of research are accommodated within the overall functions of the university is that of indirect costs, or "overhead." Application of this device to the particular requirements of individual research proposals and interpretation of pertinent regulations is a function of the office of contract negotiation. For this reason the office is sometimes misunderstood by faculty members to be exclusively a fiscal agency. Its basic purpose, however, is essentially ethical and corresponds with the intent of the first of the Harvard "Principles" quoted above. Financial surveillance is placed chiefly in provisions for institutional acceptance of funds presented in support of research, usually through an Office of Treasurer, and in detailed accountancy for each project, usually through an Office of Controller.

Offices of contract negotiation are subject to limitation of authority in that they cannot approve proposals which are not accompanied by formal assurance from academic officers that the proposed research can be accomplished without depreciation of other activities. To the same general effect, approval by the president of the university is required for proposals involving certain kinds of commitments.

> The University president must approve those proposals calling for funding of $1 million or more; providing for the establishment of new centers, institutes, laboratories, or new academic disciplines; incorporating use of University land; requiring new University money as matching funds (money not obtainable from established departmental or intercollege research unit budgets);

and calling for establishment of new tenure track positions. The president's approval is also required for the submission of any proposal involving classified research.[24]

Offices of Deans and Conflict of Interest

In December 1964 a joint statement was issued by the American Association of University Professors and the American Council on Education On Preventing Conflicts of Interest in Government-Sponsored Research at Universities. This statement cites statutes (18 U.S.C. 202-209 as amended) and a President's memorandum of May 2, 1963 (Preventing Conflicts of Interest on the Part of Special Government Employees) as summarizing restrictions which apply to faculty members when they are employed on a temporary or consultative basis by a federal agency. The thrust of the statement is to recommend extension of these restrictions by action of the universities themselves so that all sponsored research, whether or not the researchers are in federal employ, would be subject to them. The recommendation suggests formal administrative controls to be achieved through joint administrative-faculty action.

In fact, central offices of the kind indicated by the statement have not been established at many, possibly not at any, universities during the decade since the statement was promulgated. The statement itself, however, has retained considerable currency,[25] and the ends which it seeks to achieve are generally found to be acceptable. It appears that academic administrators - deans, department chairmen, directors of institutes - are judged to be better situated to deal with the wide variety of relationships capable of occurring in the many different areas of activity than would be a central office working with a complex code of rules.

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[24] Policy and Procedure in Research. The Pennsylvania State University, 1974, p. 9.

[25] Ibid.,pp. 29-30

Central administrative participation in this aspect of research control, except when particular problems arise which require adjudication, is in the maintenance of an Office of Publications Records through which all research activities within the university are made matters of public knowledge. Books, articles, papers, and other professional activities of faculty, staff, and graduate students - including all master's and doctoral theses and reports to government agencies - are listed in periodically issued bibliographies and distributed without restriction. The open and public nature of research affords means for faculties to detect and control situations which might lead to private exploitation of research opportunities.

Review Committees for Research Using Human Subjects

All proposals of research in which human subjects are to be used are reviewed prior to submission to potential sponsors. For this purpose at Penn State University two faculty committees - the Biomedical Review Committee and the Behavioral and Social Sciences Review Committee - with the assistance of a permanent staff secretary, examine all such proposals to assure compliance with the principles and requirements of the policy of the Department of Health, Education, and Welfare as published in the Federal Register. Without the approval of one of these committees, no proposal involving human subjects is permitted to be sent forward.

Health Physics Office

Research involving the use of dangerous equipment or substances - radioactive material, microwaves, lasers, or drugs specified in the Controlled Substances Act of 1970 - is monitored by technically trained staff in compliance with federal codes and subject to federal inspection.

Laboratory Animal Resources

Laboratory animals are procured and their use supervised by specifically designated officials working under the provisions of an institutional license issued by the U. S. Department of Agriculture and subject to federal inspection.

Vice President for Research and Graduate Studies

All agencies of the kinds identified above are coordinated through central administrative authority variously represented in universities by vice-presidents, provosts, deans of graduate schools, or closely related combinations of such offices in which special functions of research are supported and held in appropriate relationships with other functions of the university. Joined with research faculties through committees concerned with general policies and with detailed operations, these officers also maintain communication with agencies external to the university and are effective as centers both of authority and of information.

The responsibilities of one such officer are summarized briefly as follows:

> At Penn State a high-quality and vigorous research program is essential for two reasons: (a) the search for new knowledge is one of the basic purposes of the University, and (b) the graduate program and the support and training of graduate students depend to a large degree on faculty-originated research. Graduate study and research are therefore closely interrelated.
>
> The research organization is structured to provide necessary guidance and services. We provide assistance in locating appropriate funding sources, and help the proposal writer(s) in the planning and development of a budget within sponsor and University policies. . . . Although some degree of organization is desirable and necessary, it is felt that the best organization in this regard is a minimum one. In this way, supportive services are available, yet the freedom of the individual investigator is preserved and an atmosphere established in which scholarship and creativity can flourish[26]

Despite disclaimers of managerial power, and of all disposition to acquire any such power, officers of universities enjoy a privileged overview of the many and diverse investigations, learnings, and judgments of which the daily experience of the university is made. Direct intercommunication between some elements of the university is often difficult. Between some of its more disparate parts communication is seldom attempted. Nevertheless, the university exists in aggregate as well as in its parts, and is susceptible, if not to rigid management, yet to

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[26] Memorandum by R. G. Cunningham, Vice President for Research and Graduate Studies, The Pennsylvania State University, January 1974.

guidance and to adaptations required by the society which it is designed to serve. In the complex process by which universities change their dispositions and emphases administrative judgment appears in forms ranging from acknowledgment of a committee report to command decisions, and it is seldom without effect. Academic authority is closely linked to superior knowledge.

There are very few societal structures in which administrative authority is necessarily vested in so many different levels of organization. With regard to research the hierarchy of essential decisions involves a range of competencies from the technically explicit to broad considerations of societal need. To expect that in every instance this complex of judgments will be correctly and comprehensively resolved by any agency whatever would be visionary. However, it is not unreasonable to maintain that the way in which the kinds of problems characteristic of a university are addressed by the university is literally the only way that affords a possibility of success. By applying firm rules where rules are applicable, by assuring open access to information concerning all programs, by careful selection and approach to new problems, and all with the guiding purpose of building an institutional capacity to meet the necessities of society as they develop, the universities have served the nation well. This fact must be well understood before the necessary task of making them serve the nation better can be profitably undertaken.

On the other hand, systematic appraisal of specific research projects as they progress is not maintained on a centralized and formal basis. Because of the models afforded in the monitoring of industrial research, especially in its developmental aspects, and because of the established practices of national foundations in the selection of proposals for funding, this omission may be perceived as delinquency. It <u>is</u> delinquency when standards are not maintained by other means. But one of the deeply respected academic freedoms is that of the researcher to try and fail on his own responsibility, also to try and to succeed.

II

COLLEGIAL ORGANIZATION AND RESEARCH

"The qualities of independence and critical scholarship and leadership in basic theory, on which the whole research and development enterprise depends, will be threatened unless the central structure of the universities is made strong enough to sustain the structure of specialized research grants."

-- Don K. Price, "Federal Money and University Research," Science Policy and the University (Ed. Harold Orlans), The Brookings Institution, Washington, D. C. 1968, p. 37.

COLLEGIAL ORGANIZATION AND RESEARCH

Administrative structure in American universities is characterized by its array of colleges, each with its dean, faculties, budget, departments, assigned buildings, registry of students, and sometimes with its library, laboratories and other special instructional and research facilities. In contrast to European colleges, many of which began as corporate entitites and retain as their primary trait a proprietary and comprehensive authority, American colleges are thought of as custodians of particular branches of knowledge, as if the encyclopedic university had been sorted into categories of information according to some universal taxonomy, like a library cataloguing system. In the same manner, colleges are divided into departments. Thus the structure of a university purports to recapitulate a structure of knowledge. A department may be thought of as the organizational manifestation of an integral intellectual discipline, one of a set of related disciplines constituting a rational aggregate.

This conception of academic structure has historical validity. Among the sets of factors influencing the complex course of events which has resulted in current patterns of academic organization there is one set which in its operations resembles taxonomic system. By the effect of this set of factors chemistry, physics, and mathematics, for example, are recognized as distinct knowledges and modes of intellectual action. As a result, academic divisions appear to have the fixity of logical concepts. By extension of this impression, they appear to be static and uniform. They are thought to be static because deductive necessity compels structures of this kind to resist facts or concepts novel or alien to the sets of terms in which the disciplines were initially defined. They are thought to be uniform because all participate equally in conceptual insularity.

As a matter of fact, academic departments and colleges may or may not be static, depending upon other factors as well as on logical necessity. They are anything but uniform.

For example, a single college in a single fairly typical university looked at chronologically over a period of forty years appears in its bare, organizational description, as follows:

1930 School of Chemistry and Physics	1950 School of Chemistry and Physics	1970 College of Science
1. Chemistry	1. Chemical Engineering	1. Astronomy
2. Physics	2. Chemistry	2. Biochemistry
	3. Petroleum Refining Laboratory	3. Biology
	4. Physics	4. Biophysics
		5. Chemistry
		6. Computer Science
		7. Cryogenic Laboratory
		8. Mathematics
		9. Microbiology
		10. Physics
		11. Statistics

One element in this chronology of change is that of the growth of the university in physical size and numbers of faculty and students. The condition of growth must be assumed as basic to this and to other universities during the period of time which is under consideration. Other elements were also operative, and even in rudimentary evidence such as that cited above their effects are apparent. For example:

> Expansion of the School[1] to include Chemical Engineering and a Petroleum Refining Laboratory is indicative of awareness of problems in applied science and of appropriate adjustments with regard to the School of Engineering, which at the time consisted of departments of Civil, Electrical, Industrial, and Mechanical Engineering, with

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[1]The major divisions of the University were:

In 1930: Schools of Agriculture, Chemistry and Physics, Education, Engineering, Liberal Arts, Mineral Industries, and Physical Education and Athletics.

In 1950: Schools of Agriculture, Chemistry and Physics, Education, Engineering, Home Economics, Liberal Arts, Mineral Industries, and Physical Education and Athletics.

In 1970: Colleges of Agriculture; Arts and Architecture; Business Administration; Earth and Mineral Sciences; Education; Engineering; Health, Physical Education, and Recreation; Human Development; Liberal Arts; and Science.

some additional specialized laboratories and a department of Architecture. By 1970 Chemical Engineering had been removed to the College of Engineering.

Assimilation of programs in biosciences to the College of Science from the College of Agriculture was an effect of general reorganization of the university. The identification of certain "Core Colleges," as distinct from "Professional Colleges," was a movement in the direction of disciplinary emphasis. To a similar effect, biophysics, an interdisciplinary field which had registered solid achievement, was elevated to departmental independence. Computer Science and the Cryogenic Laboratory provided means for the adaptation of new technologies to a variety of fields. Statistics, formerly a part of the department of Mathematics, was given separate identity both to encourage independent growth of the discipline and to gain adaptability to a wide variety of problems in the social and other sciences. Mathematics also changed colleges - from Liberal Arts to Science.

A detailed history of the organizational changes reflected here would of necessity be very long and very complex. Shifts in the urgency of public concern for particular areas of research, deliberate governmental policy decisions, accidents of personality among associated scientists, of the designs of buildings, and of student interests would be influential from time to time. Constant would be the pressure of concern for the vitality and quality of proved modes of scientific inquiry and for effectiveness in address to a broad range of problems of knowledge. It would be a history of change. Although in 1950 departments of physics and of biology might both have hesitated to consider acquiring a colleague in biophysics, fewer than twenty years were required to see him established in a department of his own, and possibly hesitant in his turn to welcome the latest maverick in his science.

Through the forty years, and in this particular university, chemistry and physics remain apparent constants, a remarkably long run for organizational entitlements. But their stability of name has not deterred internal development. The people involved have changed, of course, students and faculty. And the science has changed. When a chemist of 1970 uses the phrase "the discipline" he means

something quite different from what his predecessor of 1930 meant by the same phrase, although connotations of discriminating standards, of stability, and of continuity are common to both.

A symptom of stasis or atrophy within a scientific discipline is the avoidance of questions to which answers are not already available. A reasonably high degree of sophistication in a science is necessary to frame such questions, or to recognize them when they are framed. With this sophistication, the prodding of societal need, of industrial or economic opportunity, or of simple competitiveness in understanding makes for the growth of knowledge, for the development of people capable of working in new technologies, and for expansion of intellectual disciplines. One sign that these effects have in fact accrued is the elaboration of colleges, which far from being static have reason to be concerned with "proliferation" of courses, programs, and research initiatives.

Nor are colleges uniform.

Basic differences of attitude and function are apparent in the magnitudes of colleges, in their awards of graduate relative to undergraduate degrees, and in their productivity of research.[2] Differences less easily codified appear in the contrasts between, for example, a gallery show of an artist's work, stabilization of a new forage crop by horticulturalists, and publication of geochemical research in a refereed journal. Colleges serve different constituencies, with whom they maintain relationships of different kinds, and they are maintained by resources of different derivations.

With regard to administrative functions directly related to research the colleges are similar in that each has a designated officer, for example an associate dean for research, whose responsibilities and activities are determined on the one hand by the character of the faculties and disciplines of his college

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[2]See page 75.

Colleges 1971-72

	No. of Professorial Faculty Members	Undergraduate Degrees Awarded	Graduate Degrees Awarded	Publications 1972-73
Agriculture	354	239 (69%)	111 (31%)	578
Arts and Architecture	89	200 (82%)	44 (18%)	42
Business Administration	64	874 (86%)	145 (14%)	90
Earth and Mineral Sciences	108	167 (56%)	132 (44%)	287
Education	126	1221 (69%)	562 (31%)	258
Engineering	239	620 (72%)	247 (28%)	278
Health, Physical Education and Recreation	79	161 (81%)	39 (19%)	35
Human Development	102	556 (90%)	65 (10%)	81
Liberal Arts	424	1683 (84%)	341 (16%)	548
Science	356	682 (73%)	256 (27%)	238

and on the other by his association with colleagues in other colleges in an Administrative Committee on Research and through this association with the central research administration of the university.

The differences of situation in which these several officers function are such that consideration of them under any strictly schematized set of terms could be seriously misleading. On an organizational chart each college occupies a box like that which contains each of the others. In fact they are more different than the chart implies. In order to keep their individualities in perspective, the several offices are here described on the basis of interviews with the associate deans for research of ten colleges. The interviews were not systematically disciplined, but four general topics were used as points of reference and to structure the protocols which constitute the record. The general topics were these:

1. Definition of research policy.
2. Development of climate conducive to research.
3. Characteristic modes of recording and reporting research.
4. Evaluation of research.

The protocols which follow are not self-descriptions. They were written by the interviewers[3] and reviewed by the persons interviewed, who do not object to their use for the purposes of this study.

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[3]Henry W. Sams and William E. Toombs

COLLEGE OF AGRICULTURE - Dr. Walter I. Thomas, Associate Dean for Research

Research Policy

A published statement entitled The Role and Responsibilities of the College of Agriculture defines the policies of the College with respect to its total mission. Published in 1965, the statement continues to be regarded as current and valid. With respect to research, the importance of the application of new knowledge is recognized, and this recognition is reflected in the definition of six areas of research emphasis:

1. Efficiency in the production and distribution of agricultural products,
2. Improvements in the quality of agricultural products,
3. Allocation, development, and use of land, water, and wildlife resources,
4. Institutions and services at local, county, and state levels,
5. Public policies and programs relating to agriculture,
6. Human health and well-being as related to nutrition and the safety of food supplies.

This emphasis is reflected also in the organizational structure of the Agricultural Experiment Station, with its Division of Plant Science, Division of Animal Science, and Departments of Agricultural Education, Agricultural Engineering, and Agricultural Economics and Rural Sociology. Probably because of a long history and stable funding, research in Agriculture is maturely institutionalized.

Faculty of the Graduate Research Council, a representative agency of the graduate faculty in Agriculture, works in rapport with the Research Administration consisting of the Associate Dean for Research and three of his assistants. "Blue sky" research planning is restricted by the influence of governing legislation, state and national, and by the impact of practical problems arising in all aspects of actual agricultural production as reported by field agents or directly by the industries themselves. Nevertheless, the Experiment Station Staff and agricultural faculty of the Research Council are attentive to those aspects of projects which lead into basic scientific research. The departments of Biochemistry, Botany, Microbiology, and Zoology, although administratively placed in the College of Science, retain specific fiscal and personal connections with Agriculture. In the

increasing dependence upon research "teams" the qualification of members in terms of basic sciences is of primary importance. Similarly members of the agricultural faculty collaborate on projects based in the disciplinary departments and in research institutes.

Climate

It is assumed as a basis of daily operation that members of the faculty of the College of Agriculture are available for assignment to teaching for approximately 20% of their time as needed, and that the remainder of their time is committed to research. This assumption alone would account for the high degree of professional focus which characterizes the College, and to it must be added the effects of the farms, herds, flocks, and ongoing activities in actual food production and testing. Here research is closely related to the development of product and procedure and to the level of feasible marketing.

For example, the large problem of automating mushroom production to the extent that would make competition with foreign, cheap-labor producers practicable was addressed 1968. Step by step the technology has been developed, with research production on an automated basis in 1971 and a target of commercial production in 1975. This undertaking involves the work of a team including a plant pathologist, an entomologist, an economist, and an engineer. In the Commonwealth of Pennsylvania mushroom growing is a multi-million dollar industry.

Similarly the highly pragmatic problem of the use on agricultural lands of sludge from sewage treatment plants led to a secondary question as to the effect absorption of heavy metals such as cadmium by plants, and of possible dangers to human health accruing from excessive cadmium in diet. How to assay the cadmium content of plant tissue is a basic question in chemical technique. This situation is cited as indicative of the ways in which mission-oriented research relates to the scientific disciplines.

The research climate is influenced also by the public nature of the agricultural undertaking and of the extensive communications system within which it functions. Details of this system will be dealt with below, but it should be acknowledged that the individual researcher is keenly aware of the immediacy with which his results become known throughout his natural audience and may be converted into productive action.

Reporting

All research in the College of Agriculture is conceived of in a project format, and the analysis of projects is so pervasive a pattern of thought that it takes priority over other modes of consideration. Even the "Jordan Fertility Plots," a research facility maintained without interruption for over fifty years, have project status, and the many changes of purpose and application which have marked their career are articulated by redefinition of their specific research functions from time to time.

This mode of thought is reflected in the complex system of publication and reportage by which the progress and products of research in the College are made available to a variety of audiences. Basic to this system are two series referred to as Bulletins and Progress Reports:

Bulletins are reports of finished research distributed to the interested public free of charge through the offices of County Extension Agents and directly upon request from the office of the Director of the Agricultural Experiment Station. One bulletin each year is the Annual Report of the Experiment Station and includes a short-title inventory of all bulletins, progress reports, journal articles published during the fiscal year, a list of ongoing research projects, and a list of all new gifts, grants, and contracts received during the same period. Except for the Annual Report, which contains only bibliographical and reference information, Bulletins provide specific reports addressed to the potential user, whether he be farmer, distributor, nutritionist, or functionary in a social or governmental agency. In the year 1971-72 seven such Bulletins were published, bringing the total number of items in the series to 788. Back issues are retained for continued distribution until they are exhausted. Most issues numbered below 691 are no longer available for new distribution.

Progress Reports are used primarily to release recently obtained information to special interest groups. In some instances information originating elsewhere than on the Experiment Station is included. Intended for potential users of the information, they are made available at the offices of County Extension Agents and in response to direct enquiry. Twelve such Progress Reports were issued during the year 1971-72, bringing the total number in the series to 329.

Journal articles provide the established mode of communication with other scientists. During the year 1971-72 one hundred and seventy-six such articles were published by members of the faculty, some of them in collaboration with colleagues in the College of Human Development or in the departments of Biochemistry, Biology, or Microbiology of the College of Science. Since 1966 communication among scientists in this area has been improved by the creation of the Current Research Information System (CRIS), a comprehensive information storage and retrieval system designed to provide agricultural scientist-researchers and agricultural research administrators ready access to data on approximately 25,000 current research projects at State Agricultural Experiment Stations and Department of Agriculture work units. This system reduces the time lag in communication between scientists who have work in progress that may prove to be duplicative or mutually supportive.

Evaluation of Research Activity

As they are perceived by the associate dean for research, procedures for the evaluation of research projects in the College are "less formal than they should be." Projects are initiated with specific schedules for completion, normally from three to five years. The associate dean's committee advises on the termination of each project, consulting in each instance with the appropriate department head. Responsibility for the mounting of new research projects and for the modification or redefinition of existing projects rests primarily upon the initiative of individual faculty members. Their professional judgment is basic to all decisions having to do with the content and quality of research activity.

Several factors in the situation of the College tend to compel cooperation and consultation in research decisions, and to the degree that they are effective the initiative of the individual researcher is supplemented. Most noticeable among these factors, possibly because of the relative recency of its prominence, is the need for several professional competencies in the resolution of a single set of problems. The utility of research teams has become increasingly compelling in recent years. For this reason administrative participation, if for no other function than that of identification of appropriate individuals through a number of departments or divisions of the University, has increased. Also, as a condition of its stable funding, the College is accountable to agencies of government and of society in a more immediate and specific way than are other research agencies. Mediation between the research project on the one hand and its sponsors and potential users on the other is an administrative function. Thus in the appraisal of research quality several points of view are pertinent.

In making representations of research priorities to legislative committees of the Commonwealth the Associate Dean and his advisers are guided by three general criteria:

1. Is the project one for which the College can supply superior expertise?
2. Does the project reflect the concerns of field agents and of other informants directly involved in practical agriculture?
3. Is the project presented in terms that demonstrate its pertinence to the interests represented by the members of the legislature?

It is important that these appraisals presuppose and are based upon prior appraisals which occur within the context of actual research performance. The researcher's immediate colleagues, his department head, professional peers at other institutions who read his reports and articles, and those who use his findings in practice build detail by detail understanding of the nature and the quality of his work. To a degree his own conception of his range of effectiveness is influenced by the growth of this understanding. The brilliant, "break-through"

scientist may at times encounter criticism which he ought to ignore, but if his capacities are genuine he is usually able to go the way that his insights lead him. Explicit institutional sanctions, such as denial of tenure and termination of appointment, occur when the demonstration of accomplishment is judged to be inadequate.

Because of the obvious importance of agricultural research as public service, external sources of criticism, both of the entire research enterprise and of particular programs or projects, are seldom wanting. It would be remarkable if in so large an undertaking they were never justified. Not infrequently the topics which arise in connection with the evaluation of activities within a particular institution reflect this more general discussion.

COLLEGE OF ARTS AND ARCHITECTURE - E. Lynn Miller, Assistant Dean for Research

Research Policy

In a college many of whose faculty members are habituated through experience to individual creative and scholarly work and performance, the concept of organized research, with its implications of planning, budgeting, and scheduling, is strange and to a degree forbidding. A governing policy of the College of Arts and Architecture has emerged quite naturally from these attitudes. The policy is that of encouraging faculty members to explore and consider developing those aspects of their research and creative work which are amenable to organized procedures. No derogation of the accustomed patterns of work is necessarily intended, although derogation may be at times inferred.

Responsibilities of the Assistant Dean for Research has no reference to graduate instruction, the emphasis of his work being clearly on research development. He works, however, in cooperation with the Assistant Dean for Continuing Education, with whom he shares concern for activities which are post-baccalaureate and which are for the most part externally funded. The primary resource for research in the College is the faculty itself, which with its commitment to teaching is with some exceptions unaccustomed to dependency upon grants and contracts.

Climate

In keeping with the policies outlined above, the Assistant Dean for Research works with a Committee on Research and Creative Projects which consists of representatives of each of the six departments of the College. This Committee is active, and has developed a handbook by whose use members of the faculty can familiarize themselves with procedures by which proposals can be prepared and projects initiated. Similarly, a unique procedure has been devised consisting of a "Contact Log" by which faculty members are encouraged by either of two

routes to look outside the University for support and assistance with their plans, and to do so with the assumption of cooperation from local research administration.

The research climate is also affected by the Institute of Arts and Humanistic Studies, an interdisciplinary agency within the University which is capable of providing some research support from its own resources and which, in addition, can give assistance in developing external support.

The Assistant Dean for Research seeks also to maintain constructive relationships with the several department heads, who find their first responsibility in providing instructional programs of high quality. Commitments of faculty time to research projects must be balanced with the demands of the classroom and studio, and in a faculty of relatively few members the appropriate balance is sometimes difficult to maintain. Also, in an area whose potential for research support is comparatively meager, there is some dependence upon "departmental research," the temporary or occasional reappropriation of instructional time.

Reporting

On request, the Assistant Dean for Research can quickly prepare a list of research projects currently active in the College, but there is no established system within the College for reporting research activity, nor is the subject as yet large or complex enough to require systematic procedures. It is entirely likely that activities of significance are going forward that are not accessible for a listing of the kind that is now practicable. Fiscal accountancy separate from or supplementary to that of the College as a whole does not appear to be warranted, and the practice of maintaining strict project by project records has not developed.

Some projects thought of as research, such as those in highway landscape development and the effective utilization of mobile homes, and studies in the history of art, appear to fall within familiar patterns of contractual research. Others, such as art exhibits, concerts, dance recitals, and theatrical performances involve long preparation and complex organizational effort, but the characteristics they have in common with organized research are not in all instances recognized. Deliberate cultivation of a project model entails the danger of inhibiting necessary improvisational aspects of independent creative activity. The recent creation of national funding agencies in the humanities introduces additional factors into the situation and additional opportunities. The course of future development in this area appears to be one in which definition of several different kinds of activities will be refined and procedures for their articulation recognized. The problem is not exactly parallel with that in science. For example, review of proposals by peer groups takes on a different significance when one moves from chemistry into painting or musical composition. Conspicuous talent in the performing arts, on the other hand, is often more quickly recognized, and by more people, than talent in the sciences.

Evaluation

The Committee for Research and Creative Activity has explicitly critical functions with respect to proposals and applications for support from internal funds. It assists also in the preparation of recommendations to be reviewed by the selection committee of the Institute for Art and Humanistic Study, which exercises an additional judicial function. Constructive criticism of artistic performances, exhibitions, and scholarly works is one of the basic functions of the College as a whole.

There is no officially vested authority for making evaluations of creative work. At the same time, there is probably in this College less reluctance to utter sharp judgments than in any other area of the University. Critical debate is an accepted way of life, and every participant is aware of his own susceptibility to appraisal.

COLLEGE OF BUSINESS ADMINISTRATION - Dr. Paul Rigby, Director of the Center for Research

Research Policy

Until the 1950's research in business colleges generally was characterized by the work of "Business Bureaus," agencies which collected local or regional business statistics and published or otherwise disseminated them for use in the business community. The Gordon Howe Report, funded by the Ford Foundation, and the Pearson Report, funded by the Carnegie Foundation, advised revision or modification of this activity. In addition, the functions of the bureaus were to a great extent and in most areas taken over by state governments, and in Pennsylvania this shift of responsibility has taken place. Monthly analyses of the economy of the Commonwealth continue to emanate from the College, but the main thrust of effort since 1950's has been toward substitution for the bureau functions an "institute" for faculty research more basic in emphasis and with increased identification with the disciplines of economics, statistics, psychology, sociology, and government.

This development has been influenced also by a marked increase of concern for problems encountered in government and a commensurate reduction of emphasis upon the conduct of private and corporate business. This change has been sufficiently marked to prompt some colleges of business - for example, that at the University of Missouri - to omit the word "business," with its connotations, from their official titles, substituting such terms as "organization" and "management."

Despite the clear tendency toward change, the process should not be regarded as having been completed. There has been some reaction. Heavy instructional responsibilities - 2,400 undergraduate and over 300 graduate students with a permanent faculty of 64 persons - qualify research concentration of any kind. The situation is transitional, and the disposition of the College appears to be to continue along the directions indicated by the Howe and Pearson reports.

Climate

A College Research Committee of five members is elected annually by the faculty of the College and functions under a faculty chairman to advise and monitor research activities within the College. The Director of the Center for Research, who maintains full involvement in teaching and research, is himself an elected member of this committee, and presumably could be omitted from its membership in any year if the faculty were so disposed. This committee reviews proposals submitted under the small-grants fund and intra-institutional research initiation grants. It does not review proposals designed for submission to external funding agencies.

The programs of the center for Research are designed to provide every practicable assistance in support of faculty research initiative. They are described in a "Faculty Newsletter" which was distributed to the faculty in September 1973. These support activities continue active, and demands upon staff time are heavy. Since proliferation of staff could only be undertaken at the expense of specific research projects, it is being resisted by the Director.

The faculty of this College is young. Only three of its members will reach retirement age in this decade. The sense of identification with departments is quite strong, and it is primarily on department heads and the Dean of the College that responsibility for new appointments, promotions, awards of tenure, etc., rests. Attempts by the Director of the Center for Research to form active "interest groups" cutting across departmental lines and focusing attention on promising areas of research, and of cooperation with research institutes and with other departments and colleges, have as yet not proved successful. Some cooperative research projects have been initiated, however, and are in progress, particularly with the College of Human Development, the Institute for Land and Water Resources, and the Center for Air Environment Studies.

The opinion exists that active pursuit of external support through contractual research is inhibited by the prevalence of the full-time (A) contract under which most members of the faculty of the College work. This opinion derives some support from recent experience of a change of basic faculty contract in the Department of Economics. It would appear, however, to be contradicted by the experience of faculties very active in sponsored research in which the full-time contract is practically universal.

Reporting

Except for periodic reports to the faculty of the College on internal and intra-institutional grants, no systematic project accounting is maintained in the College. Administrative assistance for the conduct of projects is maintained by the Center for Research, and through it all information necessary for responsible administration is kept readily available. The tendency to keep individual research projects in sharp definition is apparently not characteristic of the College.

One program of the Center for Research is that of the independent invitation, selection, publishing, and marketing of studies of monograph length. Manuscripts are accepted from outside the College on the basis of internal review. Manuscripts submitted by the College faculty are submitted to external review. The rate of publication is one or two monographs per year, with some restraints occasioned by the high costs of book production, particularly for books incorporating highly complex quantitative data.

Similarly the monthly economic analysis of the Commonwealth is sold, principally to institutional buyers, and otherwise disseminated through press releases, and through radio and video tapes. Receptivity to this material, which is reminiscent of the old bureau functions, continues good. Quarterly issues are focused on regional analyses, and annually an issue summarizes data

for the Commonwealth as a whole. This service is maintained principally through the work of an editor, a statistical clerk who also provides service as a programmer, and two secretaries.

Individual faculty members do not consistently succeed in developing programs of activity in which their teaching, research, consulting and work in continuing education are mutually supportive. The impression that this faculty is more susceptible than others to disparate or conflicting responsibilities exists, but apparently without factual substantiation.

Evaluation

The functions of research administration in the College are primarily developmental, designed to encourage research activity rather than to appraise research results. Through the monitoring of internal grants, the publications program, and administrative assistance in the preparation of proposals, critical advice is brought to bear. In addition, there are the informal judgments of conversational exchange and individual publications.

The strong professional sanctions appear to be administered by department heads and the Dean of the College, with advice of their committees, and with regard for the candidate's total performance. The judgments are expressed in personnel decisions - promotions, awards of tenure, and the like. In some instances, but not characteristically, members of the faculty are exposed to appraisal of their work by external committees of peers.

The College as a whole, on the other hand, is subject to periodic review by accrediting teams under procedures agreed upon by the profession at large. Organized research or individual research productivity are not primary among the emphases of these reviews, but they are taken into consideration.

COLLEGE OF EARTH AND MINERAL SCIENCES - Dr. Maurice E. Bell, Associate Dean for Research

Research Policy

Policy affecting research in the College of Earth and Mineral Sciences reflects a primary concern for the development of understanding in a complex body of knowledge, theoretical and technical, in which both students and faculty participate. The instructional programs derive their quality in large part from the effects of continuing research, but they also pose conditions under which research which does not contribute more or less directly to this quality is inhibited. This being true, it is important that responsibility for decision with respect to directions and emphases in research rests principally with those most immediately engaged in the disciplines which are taught, that is, with the faculty members themselves. The advance of a science is a product of the impact of new discovery upon established knowledge, a process in which the intelligence of the scientist himself himself is the indispensable agency. "Management" of this process consists primarily of preventing extraneous matters, including management, from interfering with it.

The College of Earth and Mineral Sciences may be characterized as having a practical bias. Its interests naturally and frequently lead to areas of scientific concern which are also areas of concern for government, industry, and the society at large. If the society were not one of considerable scientific sophistication, this circumstance might imply difficult conflicts of interest. Conflicts of interest do occur. But the concerns of society, the disposition of public resources available for the support of research, constitute legitimate factors in the problem of how research energies should be expended. Faculty members should be free to choose and to direct their own research programs within the limitations of available support.

This freedom is qualified by the fact that the development of the faculty itself is in part a product of administrative decision. Faculty members are selected for initial appointment and for retention and promotion on the basis of a complex of considerations derived from the structure of instructional and research programs. However such decisions are made, whether by peer-group evaluation, administrative decision, or a combination of both, they are in their effects policy decisions and determine scientific capabilities of a faculty over relatively long periods of time. The composition of a departmental or collegial faculty at any given moment reflects a number of decisions in which the policies governing the aggregate are implicit, and which to a degree communicate these policies to those who are in a position to understand them. Where general understanding of the rational purposes underlying complex educational agencies exists it is advantageous. However, such understanding can seldom be created by administrative fiat. It must be cultivated, and evoked. In this process administrative persuasion may play a valuable part.

Climate

The "climate" productive of research is in part emotional. Academic situations may be such as to produce an excessive number of "loners," individuals who pursue their own interests without much attention to the activities of their neighbors. Academic atmospheres are sometimes intensely competitive, involving both individuals and departments. The younger men may be subject to fear that they will not be able to make contributions sufficiently impressive to justify their retention and promotion. Such tensions can be reduced by making clear to everyone what is expected, what the effective standards and sanctions are. The younger men may be helped by encouragement and personal coaching, or by being put into contact with other scientists especially well qualified to help them. "Sink or swim" is a policy wasteful of human resources.

Personal assistance is most effective when it helps the individual to define research objectives, particularly in the development of specific proposals which may result in support of the research. This institutional participation in the formulation of research plans should not extend to terminal judgment. The scientist should have the prerogative of incurring his own rejections. Although the criticism of immediate neighbors is pertinent, and frequently helpful, to give it the authority of an external reviewing group would create an internal situation inimical to cooperative work.

Supporting services are an important aspect of the research climate. Such facilities as a machine shop, glass blowing, printing, stockroom, drafting, copying, budgeting and personnel services, expenditure accounting, and computer service free the researcher for concentration on his proper aspect of his problem. Provision of these services is an institutional responsibility, but one in which the individual researcher and his sponsors should participate to an appropriate degree. In such matters perceptive administrative guidance is invaluable.

An important aspect of the climate for research is the prevailing attitude of the college administration toward emphasis on research relative to other activities of the faculty, and the place of research accomplishment in the system of faculty evaluation and rewards.

Reporting

The effective definition of research activity in this College is an enumeration of projects. It is maintained in the form of abstracts of proposals. All proposals cross the desk of the Associate Dean for Research. An abstract of each is retained on a clipboard, and thus becomes an item in a current catalogue of research which is in prospect. When a proposal is approved and funded, its abstract is removed to a second clipboard, and it becomes an item in a current catalogue of research in progress. Proposals which are refused are removed to a third

collection and are available for analysis and criticism.

No summary reports are made on the basis of these accumulations. The contents of the clipboards are the record. However, they can be used, and are used, for special purposes. For example, currently in process of compilation[4] is an inventory of all research grants and contracts, proposals, and areas of special interest in the College that are related to problems of energy. This inventory is being made in collaboration with the Associate Dean for Research of the College of Engineering and with the assistance of a technical editor. Its purpose is to demonstrate to agencies outside the University the capabilities of the University for research in problems related to energy. It reflects awareness of the energy crisis in the Nation, and of the intense competition with which research institutions will seek support from new resources which will be made available in this area. It will also have significance for researchers within the University, whose work may be sufficiently germane to make access to new resources attractive.

Evaluation

Although the effective description of research activity in the College is on a project by project basis, it is not on this basis that evaluation of research takes place. Each project is in due course evaluated, but not specifically within the agency in which the work is done. Reports are submitted to sponsors, whose judgments may not become apparent until the next or a subsequent proposal is submitted, but who nevertheless make effective judgments. Where there is publication in the scientific journals or in separate books or articles, there is the response of the scientific community. Where the result is procedural or methodological change, the pragmatic tests accrue. The College is attentive to all such responses. The stature of the scientist in terms of external judgments is known.

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[4]Published October, 1974. A Prospectus: Energy Research 1974.

The sum of such external judgments may or may not be accepted. There is also the day-to-day judgment of colleagues, who may see in the individual's work a promise that he has not been able as yet to realize. They may see also a routine or dependent productivity that looks better to the world at large than it does to them. In any event, they register their judgments with respect to individuals rather than with respect to projects, although projects afford no insignificant part of their data. These judgments contribute to the decisions by which the membership of the research community is determined.

It is important that this process of internal criticism is seldom specifically confined to consideration of research. The individual is thought of and evaluated in all his activities, the weighting of factors being a function, more or less explicitly recognized, of the policies of the College. However, research is the one factor which, if it be of high quality, most surely guarantees the candidate's success. All others are riskier. It is in these terms that research is internally judged.

COLLEGE OF EDUCATION - Dr. Harold Mitzel, Associate Dean for Research

Research Policy

Research activities in the College of Education have been affected by two changes which are not fully understood within the University. First, funding from federal sources has increasingly been directed through channels of state and local governments and school boards. This means that tapping research funds requires continuous liaison and association with the operating units of school systems. Second, increasing teaching loads for faculty members generated by rising enrollments in the College have "squeezed out" that share of faculty time which was allocated for departmental research a few years ago. In effect this change has reduced a fundamental resource out of which research proposals and ideas can be developed by individual faculty members.

Much of the research policy which guides practice comes from the Trustees by way of Central Administration. Many of the features of an ad hoc research policy were codified this year in a statement prepared for program review by the Associate Dean and circulated in the fall of 1973. Normally policies on research have been formulated by an informal process and communicated to those members of the faculty who showed an active interest in research. Policy options left open to the College generally evolved from practice.

Operating policies in the college have focused on how the limited "hard money" could be most effectively used. The decision was made to concentrate on basic organizations to provide a foundation on which proposals and projects could be constructed. This is in keeping with the changing nature of research in education because preliminary efforts have to be well established before sound proposals can be made in most cases. Basic investments were made in the office of the Associate Dean for Research, the Computer Assisted Instruction ("CAI") Laboratory and CReWS (Center for Cooperative Research of Schools). There has been

misimpression among the faculty that a pool of research funds is available for distribution to support individual projects, within the college. There has been a strong effort by the college to put forward proposals to the University Research Initiation Grant Program but the misconception about research funds in the college still persists. The research committee of the College of Education has as its primary function the communication of information to the departments and the sponsorship of College-wide activities which will enhance research. The channels are quite specific and new research opportunities are directed toward those individuals who are most likely to have an interest. The committee itself does not review or screen proposals which go to sponsoring agencies.

Decisions on faculty personnel should reflect the intention of the college particularly if it has an emphasis on research. In practice it has been difficult, at times impossible, to insist on a strong research orientation when individuals come up for promotions. There is in fact a disparity between what is said about the importance of research and the visible facts of promotion and tenure which reflect a mixed system of operational priorities. Crucial to an effective research program is the introduction of incentives of some kind which make it attractive and interesting for a faculty member to develop research opportunities and activities. In summary, the operating policies of the college emphasize the availability of seed money for small research operations in the department budgets, the importance of programmative research as against piecemeal efforts, and dependence on the research committee for communication to and from the departments.

Several times during the course of this conversation, a point of special importance came up and it deserves to be noted here. When an organization has multiple missions, several of which present insistent demands for commitment of time and effort, then those activities which are not structured can be set aside. The negative reinforcement of research in the College of Education during the last decade has been created by the increasing instructional load of undergraduate

students and by the increasing need for service activities connected with cooperating school districts and other agencies.

Climate

Contact with extramural funding offices has been quite active and the information has been generally circulated. Within the last two years however, there have been fundamental changes within the Office of Education. Changing organization makes it impossible for one individual or even several to keep in close contact with funding opportunities. Individual faculty members are expected to get support for periodic exploratory trips to Washington from their department funds. In a similar way the identification of fruitful areas of research is viewed as a function of the department and the discipline rather than the college as a whole. Special effort has been made to keep research sponsorship diversified.

There is considerable organization flexibility in research operations notably between research and continuing education. Each supports the other in practice. This arises in part because of the requirement in educational research for operating sites ("test plots") on which ideas and projects can be tested.

The development of proposals within the college by individuals receives considerable support. Advice and consultation with individuals preparing proposals comes from the associate dean and other experienced researchers within the College. The management and business side of research operations has been improved by the addition of an administrative assistant who is developing a comprehensive computer-based reporting system on the financial state of each project for the college.

Reporting

The basic unit of support within the College is the program based on the idea set forth above that piecemeal research is less effective in generating outside support. The fundamental administrative unit for research as well as for instructional performance is the department. A few avenues of joint cooperation have been developed either within the College or with other colleges. There is a feeling that joint projects are cumbersome and frequently generate imbalances that are detrimental to the interests of all parties.

In developing an information system about research activities, it may be advisable to include all those university and college activities that are "funded in the research pattern." This would include activities which require a basic investment before they can become self-supporting, such as continuing education, public service projects. The most useful indicators for administration of research are those which relate to the flow of funds. A "money monitoring system" which would give accurate periodic reports would make it possible to track the progress of most projects.

A quarterly report of all research, both in its proposed and funded stages, is circulated and includes all continuing education and resident institution projects.

Evaluation

Proposals by individual faculty members are reviewed by the Associate Dean when the Clearance Data Form is prepared. The standing Committee on Research, made up of elected representatives from the departments, has

no role in the review of proposals and in fact its membership does not represent the strongest research competence in the College. While there is no formal review of past performance on research projects, information on the research activities and interests of individual faculty members is maintained in the Dean's Office.

COLLEGE OF ENGINEERING - Paul Ebaugh, Associate Dean for Research

Research Policy

The word policy has a special denotation here, for research policy in the College is apparently not a matter of formulated principles or procedures. It may be better described as a mode of action involving the continuing resolution of a complex of factors among which opportunities for external funding and the energies and capacities of the University, considered in every magnitude down to that of the individual engineer, are primary. The style of operation is anti-prescriptive. Nevertheless, it is persuasive.

External funding agencies tend to "put their money on the man," and not on his dean, or college, or institution. Thus as a "lead" into active policy there is a cadre of effective researchers for whom little intermediation beyond that of ordinary administrative housekeeping is required. The field of active management lies on or outside of the fringes of this effective center of activity, among younger men who have not yet established their identities in research, or among older men who, having worked out a profitable vein, are in process of moving into areas where they are not yet recognized. Similarly, aggregates of researchers effective at one time may become ineffective, as aggregates, at another.

Active liaison with governmental, industrial, and other sources of research support is a pragmatic necessity, and a basic item of policy. It is also a mode of communication by which a degree of coordination is imposed upon the very broad front of scientific enquiry. If it implies the possibility of capitulation, of vulnerability to bureaucratic error, it also implies access to knowledge of what is going forward elsewhere, and what the salient problems are thought to be. It does not inhibit the intensely focussed, "breakthrough" researcher - "I couldn't stop that kind of thing even if I wanted to."

Climate

Institutional conditions encouraging to research are among the principle objectives of what has been described above as "research policy." The freedom of the individual to initiate a project, whether in pursuit of his own interests or in response to suggestion, is fundamental. There is in the College no authority to prevent a proposal from being sent forward, although advice is offered, and may be negative. The individual may also elect to decline identification with particular projects.

Communication in a formal sense, the distribution of pertinent information from all available sources, is a routine commitment of research administration. Achievement of the intense internal exchange of ideas and influences that marks the best years in the best institutions is much more difficult. Wherever this condition shows promise of being realized, even on a limited scale within an organization, it can be helped by various means - detailed organizational adjustments, reassignment of working space, equipment, and resources for small grants, and by modification of priorities in new appointments.

There is no provision for formal decision as to where the College shall go next with respect to research. Individuals are free to follow their own leads and are encouraged to expect assistance in finding support. Departments may elect particular emphases and develop them with respect both to research and instructional programs, as may combinations of men in more departments than one. The associate dean for research participates in such considerations as an equal partner, but without the assumption of authority to organize the work of the College on the basis of a definite set of problems or missions. Underlying research is an instructional program which the College maintains as a comprehensive and integral interpretation of the current state of engineering. Between instruction and research there is a constant interchange which implies important conditions

for both. To a degree each influences the "climate" of the other, although in the exchange neither is necessarily determinative with respect to any particular decision. The conditions for research are therefore the conditions of personal freedom within a discipline recognized by the scientific and engineering community. It is only through full understanding and acknowledgement of these conditions that administrative authority can render effective service.

Reporting

A College of Engineering Annual Report is prepared in July of each year by the Associate Dean for Instruction. It is based on individual reports submitted by department heads and on fiscal information in the records of the Associate Dean for Research. It includes summary information on research activity.

At the same time each year the Associate Dean for Research prepares a more detailed report on the research activities of the College. In this report sponsored research projects are enumerated, project by project, with identification of responsible departments, principal investigator, title, sponsor, total budget, and expenditures during the year of the report. In addition, there are analyses of these data which permit comparisons with the experience of previous years, studies of relationships among departments and with intercollege institutes, of proposals submitted and funded or rejected or pending, and of the funding of research generally. Designed primarily for internal use, this report, supplemented by some information on enrollments and degrees granted in instructional programs, provides the information for the summary description published annually in Engineering College Research and Graduate Study, a supplementary issue of Engineering Education. In this standardized format, in parallel with similar information from other institutions which participate in the American Society for Engineering Education, the reports of the College become public information.

In addition, the controlling facts of each project are entered on a "blue sheet" when the grant or contract is received and its account established in the

Controller's office. The purpose of this separate record is to assure clear and detailed communication between the principal investigator, the department head, and the office of the Associate Dean for Research. This practice, which has been in use for many years, reduces vulnerability to error in the fulfillment of commitments.

In a different dimension and for different purposes, the Associate Dean for Research, in cooperation with the Associate Dean for Research in the College of Earth and Mineral Sciences, has currently in preparation[5] a survey through the two colleges of research in progress or projected which is related to the general field of energy. Recognition of a national crisis in all forms of energy has led to a readjustment of resources available for the support of research - for example, to the creation of the Electric Power Research Institute at Menlo Park, California and to meet these changes a detailed inventory of capabilities for research on problems connected with energy should be useful in relations with appropriate funding agencies. Also, researchers within the University may find in the survey advice useful to them in planning their work.

Although the standard unit of research activity is thought of as being the project, it would be an oversimplificaton to regard all projects as belonging to a single order of research. For example, the College has for nearly twenty years maintained a continuing study of the operation of institutional heating plants. Initiated at the request of a governmental agency of the Commonwealth, it has provided detailed information on the technology and economics of such operations, disseminating the information by short courses, lectures, publications, and on-site consultation. Strictly a service operation, there is no expectation that its consideration of a very familiar technology will lead to startling new knowledge. The demand, however, continues, and support for the demand.

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[5]See page 94 above, footnote 4.

On a different level of scientific sophistication, research in phenomena of the ionosphere continues, with the encouragement of a degree of organizational independence. Although this is no longer considered a new field, the intellectual quality of the work being done is very good.

Similarly, space science continues to provide a rich supply of scientific unknowns, but emphasis on it within the institution will inevitably reflect the diminished capacity of such agencies as NASA and NOAA to provide adequate support. A natural tendency of good scientists and engineers engaged in important investigations of this magnitude is to continue as long as they have access to a laboratory and interested students to assist them. The problem for research administrators which results from this situation has no easy solution.

Central to the collection and dissemination of research information in the College is the Committee for Research, which consists of representatives of each of the departments meeting under the Chairmanship of the Associate Dean for Research. This committee functions to encourage and develop research capabilities within the College. It contributes to the efficiency of communication among the departments and with central administrative officers. It neither has nor seeks administrative, planning, or judicial authority beyond that which naturally accrues to its members as members of the faculty and representatives of their departments.

Evaluation

As indicated above, the organizational structure for management of research in the College of Engineering was not designed to provide critical judgments of research projects and does not do so in any formal sense. The Associate Dean for Research reads research reports. However, the way in which his colleagues perceive his function is indicated by the fact that research reports, unlike research proposals, are not always or automatically referred to him. He sometimes has to

ask for them. Retrospective review of the content and quality of research projects is not a special or delegated function of research administration.

Judgments of persons are influenced by performance on research projects, but they are expressed in terms of appointments, promotions, and the like - the institutional decisions affecting individual research careers. Recommendations concerning decisions of this kind are initiated in the faculty member's department, where his immediate colleagues are able on the basis of daily observation of his total performance to make informed judgments. Such recommendations are reviewed at the collegial level, where the peer-group is enlarged to include members of other departments, administrative officers (including those whose responsibilities tend toward research), and, on occasion, scientific peers from other institutions. It is at this second level of decision that the candidate's performance in research reports, publications, and recognized extra-institutional service is most important.

No one aspect of the information upon which such a decision can be based is consistently determinative. The formulae tend to be complex. Among all factors, however, genuine achievement in research is the one most dependably successful. The accumulated effect of judgments of this kind should be, and frequently is, a cadre of scientists and engineers adaptable to a broad range of research problems. It is in this dimension that the valuation of academic research is most effective.

COLLEGE OF HEALTH, PHYSICAL EDUCATION AND RECREATION - Karl G. Stoedefalke, Associate Dean for Research

Research Policy

The overriding policy of the College with respect to research is that of development, to encourage research activity on a broad front and on a scale of 25% commitment of time by the graduate faculty. Research initiative must rest with the individual faculty member, but encouragement and support by the College is necessary. This emphasis is prompted in part by the fact that in the Commonwealth of Pennsylvania there are currently fourteen degree-granting graduate institutions active in the general fields of interest represented by the College, and that these graduate institutions tend strongly toward service, rather than toward research, orientations. Because of its magnitude, centrality, and public responsibility, the College undertakes to maintain leadership in the theoretical, scientific, and research aspects of the field.

Within the College a concept of research focus is in process of evolution through discussion and through the exemplary success of some faculty members. Bio-medical in orientation, the center of concern is to develop precise knowledge of the human body in healthy, physical action. Dependence upon colleagues in neighboring biological disciplines is natural and customary, but the College seeks to expand research based on initiatives originating from its own characteristic points of view. This concern prompts the maintenance of an extraordinary emphasis on performance of the human body under the demands of a variety of athletic situations, and partly for this reason the College supports intercollegiate competition in more different sports than any other college in the United States.

Climate

The Associate Dean for Research, with the assistance of a committee of three appointed members of the Graduate Faculty, referees the deployment of internal research funds, chiefly in small, "seed-money" grants. The Associate Dean provides assistance in developing proposals and identifying potential sources of external

support. All proposals are submitted through the Associate Dean for Research, but they are not reviewed by the research committee.

It is in the spirit of encouraging research leading to publication that a thesis is required of all M.S. candidates in the College, and all graduate students are required to take courses in research method and in statistics. Also, in recruitment of new faculty there is concern to favor "research persons," people with innovative ideas and appropriately balanced commitment to research and teaching.

There is encouragement of a field orientation in research - that is, of concern for effective liaison with pertinent social agencies and activities throughout the Commonwealth. The branch campuses have not as yet proved effective bases for research.

Participation in activities of professional associations is encouraged. For example, the International Association on Bio-Mechanics affords an enlarged basis of action for individual faculty members, leading to publication in appropriate journals, and to the preparation of textbook materials on the basis of researched information. Consideration of individual activities of these kinds is focused in the College committee on membership in the Graduate Faculty.

Reporting

No systematic report of research projects addressed to members of the faculty is maintained by the College. There are annual reports to the Vice President for Research and Graduate Instruction, and publications are recorded in an annual University-wide listing. Several studies in aging and others in retardation are being conducted within the Department of Recreation and Parks. It appears, however, that the concept of research in terms of sharply defined and discrete projects is not highly developed in the College.

Research which is thought of as having continuity and which is defined by characteristic subject material and methodology is exemplified in the Biomechanics

Laboratory, under the continuing direction of Dr. Richard C. Nelson, and the Motor-learning Laboratory, under the direction of Professor Monty L. Christiansen. Similarly, the Human Performance Laboratory is directed by Dr. Elsworth R. Buskirk, Professor of Applied Physiology in the College, but this program is administered with other Inter-college Research Programs, in parallel with the Research Institutes, by Associate Dean Harry D. Zook. The idea of research as programmatic, and as identified with the interests of a leading investigator, appears in this College to dominate the concept of projects.

Within the profession generally, research is reported annually in a publication issued by the American Association of Health, Recreation, and Physical Education. This publication lists graduate theses and dissertations. The Journal of Leisure Research, published by the office of the National Association for Recreation and Parks, includes research information. A comprehensive system for information retrieval has been initiated at the University of Tennessee, but it has not yet achieved full development.

Evaluation

Evaluative judgments pertinent to research activity are expressed in the College chiefly in terms of awards of research support from internal funds - such grants are regularly reported to the Faculty - and in qualification of faculty members for membership on the Graduate Faculty. In both of these areas decisions are made by committees. No formal criteria have been defined and published, but the decisions of the committees are public knowledge and in general the criteria are understood to be professional activity, productivity, and clear definition of purpose.

COLLEGE OF HUMAN DEVELOPMENT - Dr. Theodore Vallance, Associate Dean for Research and Graduate Instruction

Research Policy

Research policy of this relatively young College is developing with the College itself. It tends to be expressed in terms of organizational structure, which, although there are several subordinate administrative "divisions" with functional integrity, does not have the sharp departmental or disciplinary compartments characteristic of kindred fields of interest in other circumstances. A faculty of "people of diverse backgrounds but common interests" is a desideratum which reflects a functional, as opposed to a disciplinary, emphasis in research. It is a policy of the College to "design research programs common to all divisions."

With respect to research the Institute for Study of Human Development is the central, or "holding," agency, with limited hard money funding. Research and public service projects that require collaboration of faculty members from more than one Division are typically submitted through and when funded administered within the Institute rather than in one of the Divisions. One function of the Institute is to promote inter-Divisional collaboration. Several centers within the Institute maintain ongoing programs of correlated activity. The Center for Human Services Development, funded by the Pennsylvania Department of Public Welfare, is an example. Proposals related to social welfare policy and operations are designed drawing upon the faculties of (1) the Division of Biological Health, (2) the Division of Community Development, (3) the Division of Individual and Family Studies, and (4) the Division of Man-Environment Relations. The effect of this organizational nomenclature would apparently be to reduce insistence upon the differentia of recognized disciplinary points of view in order to sharpen the pertinence and function of research with respect to societal problems considered in several aspects. By way of another illustration, the general topic of gerontology

involves several projects and engages faculty members from all divisions. These projects together comprise the Gerontology Center, which is another component of the Institute for the Study of Human Development. Its work is coordinated by a committee.

One element in the general plan of research activity derives from the instructional programs of the College, which have been increasing rapidly in enrollments during recent years. An objective of planning is apparently to build a stable, although up to a point a growing, faculty capable of mounting and sustaining a vigorous program of research but at no point dependent for its continuity upon contractual financing. In order to achieve this objective it is necessary to recognize instruction and research as mutually supportive in an intellectual and educational as well as in a fiscal sense. Thus the most appropriate program of research would be that from which the instructional program would derive appropriate authority and renewal.

Climate

A Committee for Research made up of the Associate Dean and one representative from each of the operating Divisions functions in the College. This committee works to develop and sustain research interests and to promote initiation of projects in accordance with programmatic themes as indicated above.

All research proposals pass through the hands of the Associate Dean. Proposals intended for submission to funding agencies outside the University are not reviewed by the Committee for Research. Proposals intended for "in-house" funding - usually in modest amounts for exploratory purposes - are reviewed, and priorities set, by the Committee for Research. Central accounting is made of these projects, whose expenses provide for minimum operating essentials and do not provide released faculty time.

Emphasis of this aspect of the administration of research in the College is naturally on the work of the younger, less experienced members of the faculty. Assistance in definition of projects, designing of proposals, development of familiarity with related research in the College, forming appropriate relationships with other researchers is a continuing activity of the office of the Associate Dean. Relationships between projects and between researchers are encouraged; they are not forced.

There appears to be in this College a disposition toward emphasis on program, as opposed to projects, that has not been so clearly manifest in other colleges. Insofar as this observation is accurate, there may be a commensurate difference in research climate, a tendency for policy decisions or emphases to impinge upon individual activities more markedly than elsewhere. Possibly there is a difference also in the nature of the relationships with external contracting agencies.

Reporting

The Associate Dean for Research prepares each term a report of research activity within the College. The report is enumerative of projects, listing principal investigator, title, sponsor, beginning and ending dates, and dollar amount of the current year's funding. The report is distributed throughout the College and is generally accessible to anyone who wants to see it. All projects are reported, including those funded from "in-house" resources.

Evaluation

The Research Committee does not routinely review proposals or projects in progress or completed. Established activities of a research nature have been reconsidered with reference to criteria such as the following:

1. Whether they serve an instructional function,
2. Whether graduate assistants are profitably involved,
3. Whether they preempt laboratory space or facilities which might be put to better use.

In one instance a program was terminated on these grounds, despite the continuing availability of appropriate external support, and later reconstituted by another agency of the University. Similarly a proposal was queried on the ground that it involved research without significant relationship to other research going forward in the College. The characteristic responsibilities of the Associate Dean for Research, however, and of his Research Committee are developmental rather than judicial. As in other colleges, the crucial judgments on appointments, tenure, and promotion depend upon several factors among which research performance is prominent. A difference of emphasis from that of other colleges appears in the concern for community of interests and diversity of disciplinary backgrounds, which apparently inverts the order of priorities customary in, for example, the College of Science.

In administrative design and function this College reflects the influence within the university of ideas such as those expressed by Dean Robert Straus which are cited and discussed in Chapter III of this study. For example, members of the College regard the organization of the College of Agriculture as affording pertinent models in its fluent adaptability to particular problems occurring in the production and distribution of food and fiber. Both colleges are interdisciplinary in basic design, so thoroughly so that the word "interdisciplinary" tends to drop out of usage in them.

COLLEGE OF LIBERAL ARTS - Dr. Thomas F. Magner, Associate Dean for Research

Research Policy

Any formulation of general policy for the conduct of research in the College of Liberal Arts must be conditioned by the diversity of the elements of the College, ranging from contractual and project-oriented work of the kind characteristic of the Department of Psychology to the much less formally organized work of students in history and the languages. Some groups of researchers are accustomed to work with governmental funding agencies, to publication in refereed journals, and to citation indexes; others think of research support in terms of released time or travel grants and look for their public response in reviews of books. However, all areas share a concern for research as it informs and invigorates teaching, the faculty in Liberal Arts being among all the faculties of the University the one most heavily committed to classroom instruction.

A committee of the College, selected from members of the Faculty who give research a high priority among their interests, meets regularly to discuss various aspects of research in the College. Its function is advisory. The Associate Dean for Research is a member ex officio. As a standing committee of the College it has the prerogative of time on the agenda of general faculty meetings and of communication with the Faculty through reports or minutes. Much of its discussion is focused on the question of appropriate balance in emphasis between teaching and research in the disposition of the College's resources.

The committee on research usually includes among its members representatives of most, if not all, of the general fields of interest in the College. There is no apparent inclination to concentrate research in one or in some of the fields of interest, or to urge particular emphases within fields or combinations of fields. Research initiative rests with the individual faculty member. The purpose of the College, and of the research committee, is to support these initiatives.

Possibly because many areas of interest within the College do not relate to funding agencies of government and do not visualize research in terms of projects or contracts, the modest internal funding of research is not thought of as "seed money" and expected to produce external funding in the course of a study's development. The acquisition of equipment - except for library facilities - is not as pressing a problem as it is in a college such as Engineering. External resources, when they are available, usually take the form of fellowships awarded directly to individuals or of royalties or consultancies payable to individuals. Those areas in which research grants are available for specific projects tend under these circumstances to take responsibility for developing their own support, but with procedures which assure that the Associate Dean for Research is informed.

Climate

The distinguishing features of research climate in the College of Liberal Arts are those which derive from the areas in which project and contract patterns are not characteristic. In anthropology, economics, and psychology, for examples, these patterns are characteristic, but in other areas research has a pedagogical emphasis in that its most immediate function is to maintain and demonstrate the authority of teachers. In these areas what the individual faculty member is scheduled to teach constitutes an element in his research plans, and a radical disparity between research interests and teaching responsibilities can be limiting on both counts. Adjustment of teaching schedules of individuals to reinforce their research - and reciprocally to improve the quality of the instruction which they supply - is most readily effected within departmental offices, but some influence can be brought to bear by the College, and influence from the College may be necessary if instructoral opportunities should become rigid.

Encouragement and recognition of research achievement is facilitated through the Office of the Associate Dean for Research by assistance with application for

research initiation grants, for which younger members of the faculty may apply through the College Committee for Research, and by funds for the preparation of manuscripts, necessary travel within the continental United States, per diem expenses during periods of work at foreign libraries, research assistants, etc.

At the departmental level, time for research is scheduled for individuals when contingencies of enrollment make such arrangements possible without undue dislocation of instructional programs. In some instances - in recognition of the interdependence of research and teaching - productive researchers have time regularly assigned to research without corresponding external research funding. This procedure is by no means peculiar to the College of Liberal Arts, but it is of special importance in this College because many of its fields have only limited access to funding on the proposal-project model.

The Institute for the Arts and Humanistic Studies, an intercollegial agency, contributes to the climate for research by attracting visiting scholars and lecturers, by appointment of research fellows from among the faculties, and by direct subvention of creative and scholarly activities in which both students and faculty members participate.

Reporting

An annual publication of the University entitled Research Publications and Professional Activities lists all publications by members of the University Faculty throughout each fiscal year. Information in this publication is organized college by college, and within each college the listings are department by department. With respect to the College of Liberal Arts, these listings of end products are often the first public statement to the effect that the work on which they are based is in progress. Whether the nature of an individual's research is known in any detail even to his immediate colleagues depends upon whether he elects to discuss it with them informally in office conversations, to present aspects of it in preliminary form at departmental or other colloquia,

or to work privately and wait until his results can be published in finished form. Reports of active projects, which would be thought of in this context as "work in progress," are not appropriate under these circumstances and are not used.

With respect to exchange of information concerning ongoing research the College tends to be highly departmentalized. The "colloquia" at which new work is offered for criticism by colleagues are for the most part departmental functions. Visiting lecturers are invited to the campus either by departments or by the Institute for the Arts and Humanistic Studies and address self-selected audiences. This tendency to departmentalization may be explained in part by the fact that several departments in the College are large and comprehend broad ranges of interest within their several fields, but also by the endemic danger of intellectual parochialism.

In humanistic fields of study bibliography is the term used to describe the functions performed for the "hard" sciences by information systems. Like the information systems, bibliography has in recent years been adapted to computerized techniques, but the essential difference between the projects of science and the products of humane study remain. The distinction is at least as old as Fontenelle, who remarked that humanistic achievement tends not to be superseded, whereas scientific discovery loses identity as it is absorbed into later stages in the expanding understanding of nature. Consistent with the implications of this distinction, research in the humanistic areas is generally thought of in ad hominem terms and judgments of its value are expressed in status within disciplines. The formal hierarchy of rank and prerogatives seeks conformity with a "real" hierarchy of research authority, and to a degree achieves it.

Evaluation

Proposals for research initiation grants, applications for fellowships or special support from the Institute for the Arts and Humanistic Studies, and requests for support from the small grants fund administered by the Associate Dean for Research are subject to review. Criteria are drawn from the essential value and feasibility of the research which is proposed, from the competence of the researcher as judged by his peers, and from the promise of the research as it may contribute to the authority of the researcher and of his faculty. The function of the criticism at this initial stage is not to exclude, but to encourage every reasonable research idea. The interests of external agencies, public organizations and the like, are not crucial except as journal editors, publishers, and readers may judge the final product. Although research contributes to the validity and authority of classroom instruction, the particular research topic need not bear directly upon specific curricula or course syllabi. The capacity to give lucid expression to research results is to a degree an end in itself. Thus investigative or critical excellence in one area may be regarded as supportive of the researcher's competence in another. Individuals may elect to develop a distinctive style, or method, in research, with or without a similarly distinctive selection of subject materials. This does not necessarily contradict clearly defined specialization.

Evaluation of finished research is much more complex. The pertinent agencies are departmental committees charged with responsibility for faculty appointments, promotions, and the awarding of indefinite tenure, together with the department heads whom they advise. Authority to promote or to award tenure does not rest in the departments, but their prerogative to initiate recommendations, or to refrain from doing so, gives them authority in decisions of this kind greater than that of the hierarchy of collegial and university committees which review what they

have done. In the functioning of these committees, no other factor weighs so heavily as that of finished research whose quality is recognized by competent authority both on the campus and elsewhere. There is concern, however, to avoid mechanical application of the principle of "publish or perish," and attempts are made to recognize the individual who maintains a high level of creative scholarship although it may not result in copious publication. Popularity as a teacher takes on special significance when the students clearly comprise a legitimate scholarly audience. In summary it can be said that the proper balance between research and teaching is a continuing concern for the College of Liberal Arts: on the one hand the necessity for good teaching is clear in a college with the largest enrollment in the university, while on the other hand faculty members are acutely conscious of their obligations to generate new knowledge.

COLLEGE OF SCIENCE - Dr. Rosemary Schraer, Associate Dean for Research

Research policy

Each element of this College, and the College itself, is considered as the custodian of a discrete body of knowledge. Each body of knowledge is subject to constant expansion, modification, and refinement through its involvement in research, and to interpretation through instructional programs. This concept is reflected in the expectation that every member of the faculty will accept a dual commitment: to teaching, and to research. Superior promise in one of these two commitments is prerequisite to the first academic promotion; proved excellence in one or the other is prerequisite to the award of indefinite tenure.

Implicit in this concept is that of the University as an intellectual structure, in which the function of the College as a "Core" college is significant. This structure is subject to perturbations derived characteristically from the shifting emphases of large-scale, mission-oriented research, with accompanying shifts in the availability of research support. Counter to these perturbations is the possibility of excessive formalization expressed either in static patterns of knowledge or in organizational arrangements. The policy of the College would appear, therefore, to require a constant balancing of forces in support of continuity and proportion in both teaching and research.

To express the same set of relationships in terms of the individual scientist, a master practitioner within an aspect of science may be thought of as committed to the integrity of the body of knowledge which he commands, and hypersensitive to valid changes in that knowledge. Similarly, the effective research policy of this College, although it resists day-to-day formulations, appears to consist of a continuing resolution of differences between bases of established knowledge and their several frontiers of expansion and change.

Climate

The Dean of the College advises against overly facile adaptability to opportunities for support: "Don't do something that you don't want to do."

However, given a focus for his research interests, the young faculty member is encouraged to develop scholarly proposals and to submit them. Some of them, accustomed to working under the guidance of a mentor, are at the outset reluctant to accept independent initiative in the development of proposals. They see it as "gamesmanship," or "hustling." They tend to approach their projects with careful scholarship, seeking out the senior colleagues best equipped to help them. On occasion they consult with the Associate Dean for Research and are helped to find men of kindred interests. All proposals prepared in the College pass through the hands of the Associate Dean for Research. At this point further advice may be pertinent, particularly with regard to matters of form and consistency of statement. Proposals are not "censored" (i.e. denied the authorizing signature) in contradiction of those who propose them. This is in recognition of the quality of reviewing panels which the funding agencies are able to provide, and with which the faculty member has the prerogative of taking his own risks. It is also in recognition of the effectiveness of communication and criticism within the departments themselves, through which ill-considered proposals seldom make their way to the point of actual submission.

It is standard practice in the College to review every rejected proposal with its author, carefully analyzing the reasons given by the pertinent agency for the rejection, and developing appropriate corrections. In such circumstances the Associate Dean for Research encourages prompt preparation for resubmission. "Get the ego out of it," and acknowledge the scientific probity of reviewing panels.

In this College the development of community understanding of research by colleagues, through colloquia, seminars, etc., appears to be a departmental rather than a collegial function. Some departments are more active than others

in this regard. There is no College committee for research. Among faculty members the sense of departmental, as well as of collegial, identity is quite strong. The fact that there are some two hundred and forty biologists in the faculty of the University as a whole, while fewer than half of them are in the central departments of Biochemistry, Biology, Biophysics, and Microbiology, is perceived by the Associate Dean for Research as a troublesome, and possibly wasteful, redundancy.

Maintenance of supporting services - highly skilled machinists, glass blowers, technicians, librarians, stockroom personnel, etc. - is a necessary contribution to the climate for research, and an expensive one.

Reporting

No reports of research activity in the College are routinely published other than in the general, annual report to the Vice President for Research and Graduate Instruction, which does not include an enumeration of projects. Faculty members are attentive to national and international publications related to their fields, and to published lists of grants by important funding agencies. They are not supplied with catalogues of the work being carried forward by their colleagues, nor do they appear to find the omission inconvenient. Although it is not a matter of articulated policy, there is a tendency in the College, especially at the level of sophisticated research, to think of the several fields of science in large terms, without parochial emphasis on local specialties. Common interests emerge in terms of general areas of investigative concern, as for example the area of immunology, in which distinct research projects are currently going forward in the departments of Chemistry, Biochemistry, Biophysics, and Microbiology.

The College maintains its records of research activity in two formats: 1) fiscal files for all externally funded projects, in which research is partitioned project

by project with appropriate budgetary designations, and 2) personal files, in which the activities of each member of the faculty are accounted for. The two serve different functions in that the first supports accountability for particular projects and to funding agencies, normally on time spans of from two to five years; the second supports the accountability of the individual scientist to the institution and to his discipline, normally on the time span of his full career at the University. Furthermore, the personal record reflects commitments of research time to agencies external to the College, to research institutes and centers, and to other colleges, in which projects are administered and for which this College may have no fiscal responsibility. For this College, faculty research time is markedly an export commodity.

Some thought has been given to the question of whether a comprehensive information system for the entire University would be of special use to the work of this College. If one were developed, it should probably be based on a relatively simple "short title" or "key term" system. Quick reference to all work being done locally in relation to silicones, for example, would be helpful. Such a service would also be expensive, and it appears to be doubtful whether the expense could be justified. A more fundamental question may be whether the University represents the appropriate scale of operation for such a service, and whether a regional system like the Current Research Information System in Agriculture would not be preferable. It may be significant that there appears to be very little use, indeed very little awareness, of the services now maintained by the Science Information Exchange at the Smithsonian Institute.

Evaluation

Apart from counseling with respect to preparation of proposals described above, evaluation of discrete research projects is not an overt and formalized activity of the College. Some "peer-group reviewing" occurs at the departmental

level, but this also appears not to take the form of systematic analysis and appraisal of projects. As indicated above, unusual promise in research is one means of achieving the first promotion, and proved excellence in research is one means of achieving indefinite faculty tenure. Thus the primary focus of evaluative judgment is on individual researchers rather than on projects, although the individual's performance with respect to projects in which he has taken part is a source of crucial data. Recommendations of persons for promotion or for the award of tenure originate in departments and therefore reflect the judgment of peers in the sense that daily association in all aspects of the faculty member's work qualifies his immediate colleagues as his peers. Such recommendations are reviewed by the College, at which point the peer-group is always expanded when elevation to the higher ranks or tenure is contemplated. It is expanded by consultation with scientists external to the University who are established members of the particular cadre to which the candidate belongs or aspires to belong. At this level the importance of success in specific research activities takes on special emphasis through the impact of publications, citations, and professional "visibility." In the award of tenure, advisory committees composed of appointed faculty members in the College and from other colleges make judgments of professional quality.

On an entirely different scale and in a different dimension of judgment the College of Science has made decisions to terminate research programs of considerable magnitude. In all such instances the governing criterion has been the capacity of the college in terms of situation, equipment, support, and faculty to maintain work comparable in quality with that available to other institutions.

SUMMARY AND COMPARISON

The ten protocols quoted above are repetitive at many points, and seldom explicitly contradictory of one another. Emerging from them, however, are a number of recognizable dimensions of difference. The kinds of differences might be formulated in a number of ways, among which some are so conspicuous that they may be regarded as immune to exception, for examples:

1. Emphasis on instruction -

   The College of Agriculture in 1971-72 recommended the award of degrees to 350 candidates, four fewer than there are members on the faculty of the College. In contrast, the College of Education in the same year recommended the award of 1,783 degrees, or more than fourteen for every one of its 126 faculty members.

   This contrast may be further elaborated by analysis of the numbers of students enrolled in one college but taking course work in others. Mathematics, for example, is organizationally identified with the College of Science but provides instruction fundamental to a majority of the degree granting programs offered by the University. For such a department as mathematics the number of degrees recommended represents only partially the magnitude of its instructional responsibility. Departments and colleges for whom instruction is an "export" service are easily identifiable.

2. Emphasis on graduate study -

   In 1971-72 the College of Earth and Mineral Sciences recommended the award of 299 degrees, of which 132, or 44%, were advanced degrees. In contrast, the College of Human Development in the same year recommended the award of 609 degrees, of which 65, or 10%, were advanced degrees. It is apparent that the proportion of attention and time necessary to sustain work with relatively mature students in terms of relatively

advanced problems, including at least initiatory research problems, is much greater in the one college than in the other.

3. Immediacy of concern for development -

"Development" is here used in the sense implicit in the abbreviation "R and D." This dimension of difference appears in several ways, including:

Organizational terminology, which provides the title "Professor of Dairy Science" in the College of Agriculture for an individual who in the College of Science would be entitled "Professor of Biochemistry."

Modes of research publication ranging from operational bulletins adapted for immediate use in the field to dependence upon refereed journals with specialized readerships.

Viability in consultative functions with clearly defined groups of clients in business, government, education, and other institutional entities.

Instructional programs with explicitly "vocational" and "professional" objectives.

4. Proposal-project models of research accounting -

Some colleges maintain and some routinely publish catalogues of clearly defined, short-term projects in research which its members have proposed or which are in progress. Others do not, or do so only to the extent required for general university accountings. This difference requires particular interpretation in every instance. Perfunctory project records may indicate lack of mature engagement in a large research community, but they may also indicate preference for an ad hominem or disciplinary emphasis combined with productive research activity.

5. Research maturity -

> In the histories of universities it is inevitable that differences of situation, mission, and circumstance should have resulted in uneven development of the many fields in which such institutions undertake to be of service. A college whose record of effective research is a long one provides a climate and a confidence different from those more recently entered into activities of this kind. New colleges are not necessarily less aggressive in research than older ones; in fact, the contrary is sometimes true. The basic difference may be one of language, the older colleges having accepted thoroughly the terms and intonations needed in their daily work, while their junior colleagues are still evolving a new set for new purposes. The resulting aberrations of communication are capable of producing occasional confusion.

This summary cannot, of course, be definitive. More dimensions of difference might be suggested, and those which have been suggested could be differently formulated. The essential point is this: when research officers from all colleges are assembled - as for example in an administrative committee for research - they can together represent the total community of interests, activities, and purposes only at a general and titular level. The several special interests which they represent are not perfectly commensurate. The members of such a group have neither the capacity nor the wish to assume prescriptive authority over all the varieties of research which they represent. Their collective effect, like their effect within their colleges, is not that of control and constraints, but that of elaboration and development. In this respect they typify all academic research administration, for universities are naturally acclimated to the discovery and encouragement of talent. In research, as in instructional programs, the product when success occurs should improve upon the system which produced it. So it is that faculties

undertake to build a university better than either they or their constituents know how to ask for. When and if they build it, the next stage will still be on ahead of them, with qualities yet to be understood.

Research administrators and committees are intensely concerned with what their institution ought to be doing, as are their faculties. This question is the one on which daily work is focussed. It has many answers, in numerous fields of interest and at several levels of generality. At the highest level of generality the answer is always the same: the university itself ought to improve in the range and accuracy of understanding which it can provide.

III

INSTITUTES, CENTERS, AND EXTRA-COLLEGIAL LABORATORIES AS AGENCIES OF UNIVERSITY RESEARCH

Philosophically, the most interesting development of the last decade is the interdependency that has grown among the sciences, resulting in an integration and unity that mocks nature. We have biophysics and biochemistry, and geophysics and astrophysics, and mathematical neural-electric research, and dozens of other hyphenated interdisciplinary sciences.

-- Jerome B. Wiesner, Where Science and Politics Meet, pp. 19-20.

Beginning with the establishment of the Pennsylvania Agricultural Research Station in 1887, forty-three institutes or centers have been organized and continue to function at the Pennsylvania State University,[1] of which twenty-nine are primarily committed either to the organization and coordination or to the actual conduct of research. The rate at which such organizations have been created increased sharply after World War II but has tended to decelerate more recently. Prior to 1960 the majority of such organizations were in the sciences. Since that time similar administrative procedures have been extended to the social sciences and the humanities.

In these developments the Pennsylvania State University is typical of large, research-oriented universities throughout the nation. The creation of new, epicollegial authorities for various purposes, including organized, interdisciplinary research, is one of the recognized resources of university administration and has itself become a topic of discussion and investigation.[2]

Institutes and centers are organized in many different patterns, both with regard to their internal structures and to the ways in which they relate to colleges, departments, central administrative offices of the university, and to society at large. Like the colleges, they are neither static nor uniform. However, they all share a common characteristic in that they are different from and to a degree extraneous to the collegial structure whose neighbors they are. By virtue of this common characteristic and of their accelerated growth they now constitute a factor important

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[1] Mary M. Norman, Centers and Institutes at the Pennsylvania State University. A Case Study, Center for the Study of Higher Education, Report No. 9, The Pennsylvania State University, March 1971. p. 6.

[2] Stanley O. Ikenberry and Renee C. Friedman, Beyond Academic Departments, San Francisco (Jossey-Bass) 1972, and appended bibliography.

to the climate for research and the growth of knowledge within the the universities and throughout the nation.

An institute founded by a university and as part of the total university structure presumably must have essential relationships with some part or parts of the parent institution. Mutual independence is theoretically possible but operationally improbable. An institute which has no need for a university context may be extruded or may extricate itself from academic affiliation, but it is unlikely to continue long in a pointless alliance. For all others a necessary relationship exists, and it may be a relationship either of symbiosis or parasitism. "Parasitism" in this context is not a pejorative term. For example, the dependence of a scientist upon routine services of an institutional Computation Center may be both legitimate and desirable. Symbiosis, of course, is an ideal toward which administrative restructuring in general is directed.

One indication of institutional vitality is that of readiness and ability to engage on new investigative fronts. Such ventures test the quality and comprehensiveness of basic knowledge. An advantage which accrues from the development of institutes and centers is improved accessibility and visibility which they give to the interplay of new ideas and old ones. They help to bring critical relationships into focus, and to improve the probability of advantageous resolutions.

As an exploration of this hypothesis an enquiry was conducted during the fall term 1974 at Penn State University, and in the following manner: two statements had appeared, one published in Science[3] and the other

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3 Robert Straus, "Departments and Disciplines: Stasis and Change," Science, 182 (1973), 895-98.

delivered as a talk before a group of administrators of interdisciplinary research,[4] and had attracted notice. Both papers are critical of the departmental and collegial structures of universities, but with different emphases and degrees of urgency. (Copies of the articles are included as appendices of this chapter.) These articles were duplicated and distributed to 154 members of the academic community identified to some extent with interdisciplinary research and/or instruction. They were presented under cover of the following memorandum:

> This is a request for your assistance in an effort to collect information on a recurring question pertinent both to the review of graduate programs and to a study of research evaluation which is now going forward on campus under the auspices of the Graduate School and of Vice President Cunningham's office.
>
> My request is that you read the two attached papers by Robert Straus and Sidney Sternberg and give me your considered response to them in a memorandum of three or four paragraphs, - or more if you see fit to expand the topic in terms of your experience.
>
> The request is being addressed to all directors of graduate programs, associate deans for research, and directors of institutes. I believe that on the basis of your responses it will be feasible to put this discussion of authority as it is understood in the university on a factual basis, and to arrive at some understandings which may prove generally useful.
>
> The response requested of you is intentionally left "open-ended." I hope, however, that you will see fit to write in terms of your actual experience within the elements of the university with which you are familiar. In making our analysis of the responses - which will, of course, be made available to you - we will attempt to use equitably the items of evidence on these questions that you give us.

Apart from mention of "authority as it is understood in the university" no summary or interpretation of the two articles was offered, and the request was for "open ended" responses in terms of individual experience. Sixty-five

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[4] Sidney Sternberg, "The Management of University Interdisciplinary Research," University of Southern California Research Management Improvement Workshop, Los Angeles, July 9 & 10, 1974.

responses were received,[5] ranging from the "three or four paragraphs" suggested to thoroughgoing letters with enclosures. From this return it may be inferred that the articles touch upon matters of lively interest.

Free responses to discursive statements do not admit of quantified summary. The pages which follow are designed to provide a spectrum of representative attitudes, retaining insofar as is practicable the actual language of the respondents. As might be expected from the manner of the enquiry, all responses tend to be critical of the articles in one sense or another. Only three reject the discussion as having no immediate pertinence in their experience, all three from persons engaged in activities of humanistic interest. Among the remaining sixty-two memoranda some take a generally affirmative stance with respect to the articles and proceed to develop their own improvements and refinements of them. In this sense they may be interpreted as pro Straus or Sternberg or both. Others take a generally

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[5]The respondents, whose names and professional identifications appear as they are cited below, have the following characteristics:

Total number: 65
Professorial rank: Full 52, Associate 10, Assistant 3.

Administrative responsibility:

Deans (and one vice president): 6
Institute directors: 7
Department heads: 19

Disciplinary areas:

Humanities: 10
Social Sciences: 23
Biological Sciences: 15
Physical Sciences: 17

Interdisciplinary areas represented: Agronomy, Animal Science, Geophysics, Health Administration, Human Performance, Poultry Science, Laboratory Animals, Special Education, Land and Water Resources, Genetics, BioEngineering, Environmental Planning, Nutrition, Transportation, Applied Research, Dairy Science, Air Environment, Theatre Arts, Solid State Science, Fuel Science, Nuclear Engineering, Mineral Economics, Speech Pathology and Audiology, Petroleum and Natural Gas Engineering, Arts and Humanistic Studies, Environmental Design, Materials Research, Medieval Studies, Human Resources.

negative stance with respect to the articles and develop alternative points of view. These may be regarded as con Straus or Sternberg or both. According to this division memoranda may be distributed as follows:

	Pro	Con
Straus	14	47
Sternberg	6	55

All of Sternberg's six supporters are included among the fourteen supporters of Straus.

More fundamental is the opposition to the articles on the ground that no legitimate distinction holds between departments on the one hand and institutes on the other, and therefore that discussion of academic relationships in these terms is misleading. Division of the memoranda pro and con on this issue cannot be made with any assurance of fairness. Many of the memoranda mention it more or less directly, frequently by way of suggesting that departments have in most instances passed through phases in their history in which they resembled the current institutes, or that institutes sometimes prove to be departments in the making. The teaching of this argument is to the effect that institutes should be considered, not in general, but one at a time, each on its merits, or that the process of change is evolutionary rather than managerial. One of the memoranda advances this point of view quite forcibly:

> [6] ". . . All the two authors are saying is that departments should be replaced by other groups, designated as interdisciplinary, that would have the same functions as departments and would grow to have, if they did not have from their inception, the same strengths and weaknesses as the type of department that dominates the universities today. These present-day departments are normally as much interdisciplinary as those envisioned by the authors of the two papers in question. No English department is composed entirely of

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[6] Memorandum from John D. Ridge, Professor of Economic Geology and Mineral Economics and Department Head. October 24, 1974.

specialists in Chaucer, and just as much productive interaction can be generated between two members of an English department, the main interest of one of whom is Victorian poetry and of the other is the influence morality plays on the Elizabethan and Jacobean dramatists, as can be achieved between a Phanerozoic paleontologist and a present-day climatologist.

In short, if anyone pursuing research as a major part of his life effort is not capable of realizing what can be added to his work by collaboration with one or more other scholars in another area (or areas) of study, he will fail to make the contribution of which he is potentially capable no matter what the type of administrative unit to which he is assigned. Good people can work and prosper in any environment, academic or otherwise, but they will do best in one in which they are encouraged and supported by the administrator in charge of their portion of the major organization, no matter what the administrator's title or how his group is designated. Sternberg argues against ad hoc alignments of scholars from various disciplines as lacking the permanence needed for sound results. Against this concept it can be pointed out that a permanent, interdisciplinary group will shortly become as hide-bound an arrangement as any department now in existence. In fact such a group would be worse than the department because its members would have less in common than those of the more usual department. Once the particular project that bound the members of such a group together had been completed, they would be far less likely to form themselves into another, and equally viable, group than would members coming together as a result of a recognition of a common interest in, and ability to contribute to the solution of, a problem of interdisciplinary character.

The contradictory position is also expressed, in which parochialism is accepted as a native characteristic of departments and colleges as such. Even where one or the other of these positions is asserted quite categorically there is also qualification which indicates that the difference is a matter of point of view as well as of objective fact. For example:

[7]With reference to the "power base", it is felt that this is departmentally oriented at our University. Though one frequently wonders whether one should say it is college oriented. There is reluctance to cross traditional, departmental, or college boundaries. . . . This applies to both education and research. The structure is maintained primarily because we are reluctant to change and we like the status quo.

There are difficulties in attempting to conduct interdisciplinary programs in both the education and research areas which are frequently discouraging. It is the writer's opinion that we at Penn State have fewer difficulties than most other institutions. It is gratifying that so much does get accomplished, and that interdisciplinary programs do work as well as they do.

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[7]Memorandum from William J. Moroz, Professor of Mechanical Engineering and Director, Center for Air Environment Studies. October 18, 1974.

Although the distinction between institutes and established departments may at some points tend to become hazy, it appears to have furnished the terms in which discussion of the issues involved is currently practicable. Both Straus and Sternberg win approval to the degree that they are recognized as having evoked significant problems. As will appear, the respondents accept the terminology as viable and develop from this terminology the topics of debate most useful from their several points of view. It does not follow that because of their common origin the terms and topics retain single and consistent meanings as they are used in the variety of situations to which they apply. In any terminology of this degree of complexity, semantic slippage occurs.

In order to illustrate ways in which the various aspects of this set of problems is understood, twelve of the memoranda are here quoted in full. The twelve were selected on the basis of their representativeness and from among those which constitute fully developed statements. All of the authors but two are engaged in activities generally thought of as interdisciplinary in nature. Four of the authors are identified with research institutes. In order to minimize bias in presenting these memoranda they are quoted in alphabetical order, based on their authors' names. They are numbered from 1 through 12 for convenience of reference.

Memorandum 1:[8]

Sternberg and Straus proceed from the assumptions that Universities should solve society's problems and that interdisciplinary research solves such problems better than disciplinary research to the conclusion that Universities should be restructured to encourage interdisciplinary research at the expense of existing disciplines. My experience and thinking on the matter leads me to question their assumptions and the long term implications of their conclusion. Moreover, even if their assumptions and conclusions are

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[8]Memorandum from Ronald Abler, Associate Professor of Geography, October 22, 1974.

sound, I foresee difficulties if the policies that follow from their conclusions are applied by the social sciences and humanities.

The first premise, that a University's overriding concern is or should be solving society's current pressing problems, does not enjoy universal support inside or outside the academy.

The second assumption, that interdisciplinary research solves problems better than disciplinary research, remains to be demonstrated. Straus has fallen into the trap of confusing disciplines and the content or knowledge they possess. A discipline is a community of scholars who ask similar questions. A discipline's "knowledge" resides not in the answers to its questions, which obviously change from time to time, but in the questions themselves. To the extent that the questions are valid queries about human experience or physical phenomena, they provide unity and cohesiveness for decades or centuries even though the answers or "facts," as Straus disparagingly refers to them, change. It is not "logical and necessary that the boundaries of disciplines should change" as knowledge changes. Disciplines need change only as the questions they ask become invalid, unimportant, or inadequate. Geographers have been asking the same fundamental questions about places, people, and their interrelationships for 2,500 years. The answers change every time the same question is asked because the world changes; geographers get different answers for that reason, not because they are asking different questions or because the discipline has changed. Straus' arguments on this point are strawmen.

More charitably, we could assume that he simply hasn't thought carefully about some of his assumptions. Sternberg and Straus buttress their conclusion that Universities should be restructured with unsupported assertions that interdisciplinary research is growing by leaps and bounds and that it cannot flourish unless the alleged stranglehold of traditional disciplines is broken. I'm not convinced that either assertion is true. I've noticed no upsurge of interdisciplinary research during the last decade and neither Sternberg nor Straus document their claim that it is burgeoning. Also, they ignore the possibility that the increases that have occurred might be a response to the increased funds available to support such research. The authors' dismal view of disciplinary parochialism approaches a crude caricature. In the geography departments in which I've worked, cross disciplinary contacts and interdisciplinary research and publication are highly regarded and more likely to promote than hinder the advancement of those engaged in them. Geographers consider the ability to hold one's own outside the discipline to be a desirable trait.

I am wholly in favor of interdisciplinary research. Because practitioners of different disciplines view the same physical or social phenomenon through different theoretical frameworks and ask different questions about it, such research can be especially stimulating and productive. But both Sternberg and Straus are badly mistaken in their belief that ad hoc interdisciplinary research is not the proper way to proceed. Based on my experience and that of others I know who have tried interdisciplinary research, I contend that ad hoc procedures are the only ones that will work. Interdisciplinary research prospers when a clearly defined, soluble problem is tossed into the laps of a team of experts who possess relevant expertise. Sternberg's aphid infestation is a classic precisely because the problem existed before the research team was formed and because the research team was formed with that

specific problem in mind. Had the same team stayed together after they eliminated the alfalfa aphids and tried to find a new problem to solve, chaos would have ensued. Straus attributes the failure of the Yale program to disciplinary interference. An equally probable interpretation is that it was terminated because its members (like those at the recently terminated program in Science and Society at Harvard) spent inordinate amounts of time, money, and effort trying to figure out what they were talking about and what they should do. In the absence of a common disciplinary perspective or a clearly stated problem imposed from outside such a group, little progress can be made. Interdisciplinary teams find it difficult to formulate problems because they don't speak the same languages.

It is tempting to think that the interdisciplinary research process might be institutionalized in the service of society, but I think that adopting interdisciplinary research as a University goal, as Sternberg suggests, would be as shortsighted as adopting disciplinary research as a major goal. Neither goal comes to grips with the basic questions concerning the Unviersity's role in society.

Universities have gotten themselves into no end of trouble by trying to be too many things to too many people in their quest for financial support and prestige. Universities are (or at least should be) places where people can think and teach others how to think. To the extent that Universities prostitute themselves by styling themselves as physicians for societies' ills and by scrambling after the megabucks that are available to those willing to assume that role, they vitiate their most important potential contributions to society and civilization. Sternberg dangles NSF's alluring millions, and Straus seems to argue that since an activist role for Universities is inevitable, we should relax and enjoy it. I cannot accept with equanimity their proposals that we restructure our Universities into Centers for the Absorption of Federal, State, and Local Funds. People in interdisciplinary research centers and institutes quickly come to spend more time writing proposals than doing contract research, and between the two there is precious little time for teaching and thinking. Unless I've missed something, the words "teaching" and "students" appear only once in these two essays, which is probably indicative of how much attention they would get in a University structured along the lines suggested by Sternberg and Straus.

Finally, what validity there is in the arguments put forth in the two articles seems to me to hold only for the "hard" sciences and technology. I don't see how the agricultural extension model cited by Sternberg could be carried over into the social and behavioral sciences and the humanities. A state or local politician may look benignly, even kindly, upon an extension agent from the state University who is helping his constituents get better corn yields. I shudder to imagine the same politician's reaction to an extension agent sent out by the Political Science Department of the same University to help his constituents get better government. The professional schools Sternberg proposes, schools of petroleum, plastics, coal, iron and steel, estuary waterways, atmospheres, and pollution, make it clear that his ideas have little relevance in the Liberal Arts and Social Sciences.

Let me summarize what started out as a much shorter commentary before I got angry by saying that:

1. I am not convinced that interdisciplinary research is the wave of the future and that disciplines and departments are impediments to the successful pursuit of interdisciplinary research by those so inclined. My experience in both points is to the contrary.

2. It would be a mistake to undertake serious tinkering with current University power structures in hopes of promoting interdisciplinary research. It's not necessary, it wouldn't produce the advertised results, and to the extent that such tinkering weakened disciplinary power structures that have valid and good reasons for existing, it would do great harm to our Universities.

3. The Sternberg and Straus proposals are outgrowths of mentalities that view Universities as Think Tanks rather than educational institutions. Adopting this viewpoint would be fatal, especially for the social and behavioral sciences. Society's pressing problems are social and cultural in the final analysis. Trying to solve them would inevitably enmesh the University in political processes that would destroy its role as an institution devoted to teaching and research.

Memorandum 2:[9]

I have read the two papers by Robert Straus and Sidney Sternberg on the role played by departments and disciplines in preventing interdisciplinary research in Universities, and on the need for Universities to turn to and devote major energies to interdisciplinary research in order to help the government solve societal problems.

First of all I should say that I have been thinking about these problems for more than 15 years. My ideas are largely documented in two papers which I published in the house organ of the Earth and Mineral Sciences College: Material Science - A Plan for Research and Graduate Study, Mineral Industries 31, No. 1, October 1961, and Interdisciplinary Instruction and Research in the College of Earth and Mineral Sciences, Earth and Mineral Sciences 42, No. 9, June, 1973. A paper based on the first article was also published in the Journal of Metals, May 1962 and in some other journals. I am enclosing copies of these.

Let me first discuss the article by Sternberg. The Federal Government has been putting pressure on the Universities at least since 1955 to add large interdisciplinary research activities aimed at solving major societal or industrial problems. In the period 1955-62 the emphasis was on "materials research." In the late 60's it was on problems in the urban society, then conservation of the environment, and now it is energy research. The paper by Sidney Sternberg is one of the best examples of an attempt to get the American universities to reorganize to function at the pleasure of the government in solving societal problems without understanding our concern for the effects which this would have on higher education itself and on the institutions thereof.

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[9] From Maurice E. Bell, Professor of Geophysics and Associate Dean for Research, College of Earth and Mineral Sciences. October 28, 1974.

I agree that many problems of society, including those of how to operate companies at greater profit, are interdisciplinary, though not all of them are.

In his article "Departments and Disciplines: Status and Change," Robert Straus implies that the major obstacle to university reorganization along interdisciplinary lines is reactionary self-interest of professors in academic departments who have traditionally regarded them as the fundamental building blocks of university organization.

Both of these authors seem to accept as a basic premise without argument, that interdisciplinary organization in universities is more desirable for research purposes and possibly also for teaching than the traditional form of university organization in departments, based on academic disciplines. My own views on these questions are as follows:

1. The universities should remain structured primarily in departments arranged around basic disciplines with a liberal sprinkling of interdisciplinary departments (like biophysics, for example) and applied departments, many of which are implicitly interdisciplinary (like the Material Sciences Department, which employs chemists, physicists, mineralogists, engineers). The primary mission of the University is still teaching, although our government friends may think it is research on society's problems. It is the teaching mission, and not a perverse and reactionary resistance to change, as Mr. Straus seems to think, that prevents the University from being restructured into a vague interdisciplinary continuum, or even into broad problem-oriented divisions each containing various fragments of the basic disciplines as we know them. I believe that an effective education requires a student to be oriented towards one basic discipline. After that, he can add facility and knowledge in other disciplines without becoming chaotic in his perception of knowledge or lacking in depth, as I suspect many are who are educated only in problem-oriented interdisciplinary departments.

2. Research in the basic disciplines produces the fundamental knowledge upon which new advances in applied science and engineering are based. It has been said many times since World War II, and I believe it is true, that we in the U.S. are rapidly depleting the store of fundamental knowledge, and that more, not less attention should be paid to replenishing the treasury. The production of fundamental knowledge is indigenous to the University, more so than to the government laboratory, the industrial laboratory, or the research institute. Fundamental knowledge, and the production of it, are utilized directly in the educational process. Conversely, interdisciplinary, problem-oriented activities seldom produce additions to fundamental knowledge.

3. I believe, with Sidney Sternberg, that "interdisciplinary research is an equal goal and objective in the university along with education and individual discipline research" (Sternberg, p. 2) - at least that it is an almost equal goal. The problem is, how to achieve it.

Neither Mr. Sternberg nor Mr. Straus has seen the real cause of the problem with interdisciplinary research in universities. The real problem is the nature of the financial support which the Government and also industry has been

willing to offer the universities in recent times for research. Mr. Sternberg speaks in glowing terms of results achieved by the agricultural research and technology system since passage of the Land-Grant Acts. He presents this system as a model for interdisciplinary achievement in universities. What he does not say is that the Land Grant Acts secured long-term continuing funding, the responsibility for management and control of which was broadly vested in the universities themselves. Several attempts have been made during the last ten years to get through Congress a law establishing similar support for university research of various kinds; two attempts have failed in the last five years to establish research and educational programs in mining and related mineral industries with continuing Federal Government funding, and with matching funds from each of the State Governments, just like the Land Grant programs in Agriculture. This speaks loudly for the greater degree of anti-intellectualism prevailing in Congress and the Executive during the latter half of the Twentieth Century than prevailed in 1862 when the first Land Grant Act was passed.

If the Universities are to establish viable interdisciplinary research groups, both tenure and academic titles must be offered to attract the highest quality of academic personnel, because these people must have jobs that are as attractive as those held by faculty members engaged primarily in teaching and in individual discipline research. This has not been possible in view of the on-again - off-again funding available from either the U.S. Government or from industry. In order to prevent a build-up of large numbers of tenured faculty in interdisciplinary research institutes, laboratories, and centers without either a teaching mission or assured salary support for the future, the University wisely decided in the 1960's to require all actual or proposed members of such interdisciplinary research activities to be at the same time members of academic departments, and to require that their initial appointments, and the granting of tenure and promotions to them be controlled by those departments. This is exactly what Messrs. Sternberg and Straus are complaining about, along with the various directors of the interdisciplinary research organizations in the University. A good discussion of these problems is contained in "Centers and Institutes at the Pennsylvania State University," by Mary M. Norman, Report No. 9, the Center for the Study of Higher Education (1971), pp. 21 ff. Had the University been assured of long-range continued financial support for these entities, together with responsibility for their management and control, it would not have been necessary to make the decision to have all faculty in interdisciplinary research units attached to and controlled by departments.

In summary, I believe that the basic disciplines and their corresponding departments do serve a much needed purpose in providing a stable framework for knowledge, preventing intellectual chaos, providing opportunities for adding to our store of fundamental knowledge and truth, and insuring that advanced students are educated in depth in at least one area of knowledge. Without recognition of the basic disciplines, there would be no restraint applied to the tendency for proliferation of departments and disciplines formed from interdisciplinary combinations, in the university.

I also believe that, with long-term financial support from government or elsewhere, interdisciplinary research groups will grow and flourish side by side with the academic departments comprising the basic disciplines.

Memorandum 3:[10]

The concern here, I suppose, is not with small interdisciplinary projects where two or three professors from different departments cooperate on a particular piece of research. This is a frequent occurrence; the problem is the establishment of larger and more permanent interdisciplinary research programs.

It seems to me that Straus exaggerates the inherent difficulties of operating such programs. Perhaps I feel this way because my discipline, physics, is so basic that we can contribute to any program in the sciences or engineering without losing identity or recognition. On the other hand it is true too that the physics input required by interdisciplinary research is often on the technician's level and does not warrant faculty participation. A second comment to Straus' paper concerns his emphasis on departmental power as a hindrance to interdisciplinary research. At Penn State, the power really resides in the college Deans' offices. I am obviously not going to state that they are a hindrance, but I can see that they might be since the sociological pressure requires each Dean to strive for excellence of his college or of the departments of his college. The recent shift of responsibility for tenure and promotion from department to college (and to the central administration) appears to me to make it harder rather than easier to identify and reward honest extra-disciplinary efforts of faculty because the higher level of hierarchy simply has less chance of knowing about the actual performance (just as it makes it harder to give consideration to the teaching contribution of faculty members!).

The proposed (Sternberg) establishment of "schools", each pursuing a well-defined aspect of either energy or conservation related research has merit insofar as it points to the necessity of having a long-range program. I would rather call them "institutes" with the idea that the majority of cooperating faculty still be members of their traditional departments. In this way it is easy for faculty to shift into or out of these applied areas, depending on the needs of the program. If these institutes or laboratories were to be run as "schools", they might harden into empires just as the department or colleges are alleged to have done. There would then be physicists, for example, whose allegiance would be to one of these schools and the transfer to another unit might be more difficult than it is now. Instead of parallel and competing departments one would have a structure of parallel and competing schools of applied research. This might not seem to be any worse, were it not for the fact that the "cutting edge" of scientific inquiry would get lost. There is no way to argue against the statement that applied research will not lead truly to better basic knowledge. The latter is still best pursued in the traditional disciplines.

There is no reason, given a measure of good will (particularly perhaps on the part of the college Deans), why interdisciplinary programs should not work well within the discipline-structured University. But it seems clear to me that truly novel scientific research would have a hard time in an applied-

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[10]From Ernst Bleuler, Professor of Physics. October 10, 1974.

program-structured University. I believe that an interdisciplinary institute will be successful in enrolling the efforts of faculty, if it has a good program and if it does not make an effort to divert the discipline loyalty of the faculty.

Memorandum 4:[11]

Your memorandum and attached articles were of great interest to us in that we continue in the process of organizing and developing the academic program in the graduate program in Community Systems Planning and Development. We have recognized the potential strength of pursuing an interdisciplinary and interprofessional program but are also keenly aware of the management problems that I think are inherent in such an arrangement. I will identify here some of the considerations that I think are inherent in an interdisciplinary program such as ours and describe some of the approaches we have taken to address situations we have experienced.

First of all I would caution against the notion that interdisciplinary or multidisciplinary programs are inherently more dynamic and innovative. To support this point one need only survey many of the professional programs in universities that are almost by their very nature interdisciplinary but frequently exist to disseminate facts and to assimilate one into a profession as opposed to the search for knowledge. Because our program has a strong professional orientation, its interdisciplinary nature poses really little threat to the academic program per se. There is, I think, a constant danger of interpreting the multidisciplinary or interdisciplinary nature of the program as nondisciplinary. If the program were allowed to drift in a nondisciplinary direction, it would quickly become a training program for professionals where certain facts accepted by the profession are disseminated for student consumption.

An issue related to the professional nature of the Community Systems Planning and Development (CSPD) program is the professional identity and credibility of the faculty and students within the program. The CSPD program was structured around an academic model including the identification of the faculties involved in the program, from the Division of Biological Health and the Division of Community Development primarily, as well as the name itself. This academic orientation and identification conflicts with the professional identification of the faculty and students within the program. Because many of the students are pursuing careers in a professional area, this poses problems of acceptance of both students and faculty in these professional areas. The purity of the academic model is also protected from membership and accreditation from external professional organizations and societies.

One of the major issues that arises in maintaining a multidisciplinary academic program is in program administration. The CSPD program as such does not have its own administrative integrity but draws on the budgets and the

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[11] From Gordon D. Brown, Associate Professor of Health Administration, College of Human Development. October 29, 1974.

faculty resources in a number of academic departments and divisions. The justification for involving these departments and divisions, however, is based on the desire to involve them in the academic program. The effect of this involvement in terms of program administration is to introduce great complexity in coordination and management. In our experience it is clear that the soundness of the design of an academic program can be justified only to the degree that that program can be properly maintained. Additional consideration, therefore, must be given to program administration.

An additional consideration in multidisciplinary research and teaching, and one that Straus identifies, is the inherent additional requirement by faculty in advising, coordinating, setting program policy, and evaluating. There is a wide range of program orientations and student interest within the CSPD program, and therefore, it is more difficult and less desirable for the program to establish narrowly defined policies and procedures for the teaching and research functions. As a result of the increased flexibility needed to foster an environment for innovation, there is much more individual attention in terms of student advising, the development of a student plan of study, instruction, and student examination and assessment. An example of this coordination would be the number of courses that we teach on a term basis to provide the various perspectives that are necessary to include in the program. The problem that is created is that traditional college and university criteria for evaluating faculty performance, i.e., courses taught, numbers of students advised, and numbers of student committees, do not properly take into account the additional effort required of faculty to maintain an interdisciplinary program. In short, as Straus points out, traditional university and college criteria for faculty work load, promotion, tenure, etc., are based on the traditional notion of performance with academic disciplines. I would say this is a major problem in interdisciplinary and interprofessional programs and one which we are giving considerable attention to.

A final comment I would make in this memo concerns the desire to maintain an academic program integrity. This issue is particularly relevant if the program includes a teaching function and relates to the creation of a program base or core curriculum. Because the program is interdisciplinary and interprofessional, there is an inherent assumption that there will be a wide range of academic and professional backgrounds represented on the faculty, and the program can give the impression that it will take on all comers. It is our opinion, however, that direction of the program should not be determined according to which faculty members get interested in it and apply for membership on the faculty. Instead the program should determine its direction and set its limits and seek and evaluate faculty composition on the basis of the program direction and the rate at which the program is developing. Certainly multidisciplinary cannot be equated with lack of direction and lack of program boundaries. Our motto in the graduate program is that "if CSPD is everything, maybe it is nothing."

I hope that these comments are useful in your program review. I am very interested in the process and outcome of this review and would like very much for faculty members from our program to be invited to participate. It is an important area of inquiry and for us a very timely one.

Memorandum 5:[12]

The fact that I have been associated with the interdisciplinary approach to problems all of my professional career provides a clear label for my interests and beliefs. Certainly the boundaries of disciplines change and they change because the process of asking meaningful questions and formulating hypotheses usually stretches boundaries. The process of dealing with change involves either acquiring the basic knowledge needed to deal with problems through additional education or training (no matter how obtained) or engaging in collaborative effort with someone who already has the knowledge. The process that I have grown to appreciate and accept is a combination of these that involves a team approach to problem solving utilizing people with different but complimentary backgrounds and training, e.g., in our own program we have: physiologists, biochemists, physical educators, anthropologists, industrial hygientists, physicians, electrical engineers, mechanical engineers, statistician and computer scientist. In turn, all of these participate in some way in the educational programs with which we are involved.

Unfortunately, it is true that a department can be stifling but this is not exclusively due to the structure but to the people who are in it who insist on maintenance of the status quo and who refuse to allow the fringes to extend. The holding force is the economic one which is related to the parceling out of money and promotions in strictured and repetitive ways.

Despite what I have said, there is order and value in a stretchable departmental system if the "fringes" are allowed to extend and the area of activity allowed to remain flexible. Professional societies form the basis of common interest and provide a mechanism for information exchange and also provide, in large measure, the literature for graduate education via the professional publications that are sponsored. Here a useful peer review process (frequently world wide) is built in because of the usual requirement for reviewer approval of submitted manuscripts. But even the societal system, which departments tend to imitate, must remain flexible and facilitate change.

As far as Penn State is concerned, I believe we have been forward looking in sponsoring such activities as the Institutes for Science and Engineering, the Intercollege Research Programs, and yes - even the College of Human Development (on Human Involvement) as amorphous as the latter is.

To change for change's sake is as arbitrary and capricious as adherance to a rigid departmental structure. But recognition of the fact that some change forms the very crux of knowledge expansion eases the pain of gradual transition - and preserves the very gist of a University's reason for being.

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[12]From E. R. Buskirk, Professor of Applied Physiology and Director of the Human Performance Laboratory. October 10, 1974.

Memorandum 6:[13]

By definition, the term "interdisciplinary" admits to the existence of disciplines. Further, the laws of supply and demand, in both the short and long term, determine the creation, life and ultimately the death of disciplines. Supply is represented by students eager to learn the subject matter and professionals eager to use and/or add to the subject matter. Demand is represented by society's need for practitioners of the subject matter plus a willingness to foot the bill.

Multi- or interdisciplinary areas often develop into disciplines in their own right - whose lifetimes are determined by the same laws of supply and demand. Other disciplines simply fission from a long-established discipline, particularly as demand for applied aspects develops. Originally engineering consisted of civil as distinct from military. The other influences spawned electrical (from physics), mechanical and industrial (the industrial revolution) and nuclear (an interdisciplinary activity that grew) - to name a few. At the turn of the century a few universities considered railroad engineering as a discipline. Penn State once had an instructional program in electro-chemistry. Both have died.

In my judgment universities should maintain sufficient flexibility to allow disciplines to be created, regardless of their probable lifetime, so long as the criteria of supply and demand are met. Experimentation in this direction (and in the short term) is what interdisciplinary activities are all about.

However, the basic disciplines that have faced the tests of time (greater than 50 years) must be maintained. Education and research in these are necessary for continuity and to add to the basic fund of human knowledge.

Engineers and scientists are a gregarious lot, never mind the willingness of some to experiment with interdisciplinary activity (and for some to change to newly created disciplines). Experiments in the establishment of non-discipline-departmental structures at universities have failed, as witness Southern Methodist University.

So, we at Penn State are pretty well structured and balanced. We have our basic department-disciplines together with interdisciplinary structures allowing for experimentation in research (our inter-college research programs) and instruction (the graduate programs.). The life of these experiments depends on the previously stated laws of supply and demand. Close attention to indicators of these influences is required of a progressive university administration. Encouragement of new ventures should be a continuing possibility yet caution should be given to not "flog dead horses" no matter how beloved. Dr. Ralph Siu has his own version of The Golden Rule which states "He who has the gold, makes the rules." The administration must be attentive to societal needs as evidenced by external funding potential in considering the continuation of an interdisciplinary program of research (and possibly of instruction).

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[13]From Paul Ebaugh, Professor of Engineering Research and Associate Dean for Research, College of Engineering. October 21, 1974.

I believe that the administrative officers of a university should make decisions effecting the life and death of programs. If they are unwilling to do so, or if their record is bad, they should be replaced. The making of decisions is what they have been trained (and are paid) to do.

Enough said!

Memorandum 7:[14]

Attached are my reactions to the two papers on inter-disciplinary research that you transmitted in your memorandum of October 3:

Departments and Disciplines: Stasis and Change -- Robert Straus

Many will agree with the trends presented in early sections of this paper. The ever increasing momentum of change, the need for adjustment, the locus of power in departments, and the structural rigidity of our universities are valid observations. Where I take issue with Mr. Straus is in the last two sections and the summary.

I am not as confident as the author that departments must either realign "their spheres of control over disciplinary activity" or "lose the power of control over basic academic decisions and rewards." Nor am I convinced that the solution is for them to "redefine their discipline-oriented identities and re-align the priorities to include cross-disciplinary inquiry."

Academic power must reside somewhere in a university, and I am convinced that I will remain with departments and colleges. Further, I see very few forces at work to encourage departments to change and expand their disciplinary boundaries. One may even raise question as to whether they should.

The central problem in many of our universities today is a "closed" organizational structure. The existing set of departments and colleges--formed long ago to serve industries and professions such as agriculture, mining, engineering and medicine--is ill-designed to accommodate the academic needs of public agencies. Mr. Straus suggests a retreading of existing departments. My solution is to open the door for the entry of new units into the system.

Penn State's inter-college program is a step in the right direction, but we still try to hide our institutes and centers and keep them from becoming multi-functional units. Apparently our administrators feel that they do not have enough power to persuade deans and department chairmen that inter-college units are deserving of full membership within the academic fraternity.

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[14]From John C. Frey, Professor of Land Economics and Director of the Institute for Research on Land and Water Resources. October 10, 1974.

When I made a study of institutes and centers at Land Grant Universities several years ago, one administrator told me that every university should have a developmental college, separate from all others, into which new teaching and research programs could be placed. This college would be a testing ground for new ideas. Some of the programs undertaken would fail and be dropped; others would succeed and be assigned a permanent position in the organizational structure of the university. I believe that this approach has merit.

The Management of University Interdisciplinary Research -- Sidney Sternberg

Although I am inclined to agree with some of Mr. Sternberg's recommendations, his paper as a whole is extremely weak. He obviously is in favor of interdisciplinary research, but, in my opinion, for the wrong reasons.

Interdisciplinary research is not an end in itself. The objective of research is the discovery of knowledge. Sometimes only one person and one discipline are needed. At other times the problem may call for the expertise of an entire interdisciplinary team. The interdisciplinary approach is not a "cure all" for the ills of university research. Nor is it a guarantee that the work of the researcher will be applied rather than theoretical.

Very little interdisciplinary research is being undertaken today, even under the direction and management of research institutes. In interdisciplinary research, propositions from several disciplines are blended together to form the hypotheses for study. Only on rare occasions does this integration actually take place. More often the conceptual framework in team research is a tossed salad of propositions--each construct maintaining its identity with the parent discipline. In this latter case, the chief benefit is coordination of the work so that all efforts are directed toward the solution of a common problem.

I doubt very much that we can rely on interdisciplinary approaches alone to make our research more useful to society. As an institute director, I am pleased to have Mr. Sternberg on my side, but I wish that he would strengthen his arguments for the support of interdisciplinary programs.

Memorandum 8:[15]

Following is my response to your memo of October 3. I suppose I have been involved with Bioengineering almost from its inception as a recognized academic discipline. My early involvement was at the University of Pennsylvania which was one of three schools which received initial support from NIH to establish training programs in biomedical engineering. During that time we had a number of conversations concerning the development of an inter-

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[15]From David B. Geselowitz, Professor and Head, Bioengineering. October 21, 1974.

disciplinary field in the university environment. We recognized the difficulty of an interdisciplinary program growing in the situation where the power base was in the departments. Many of the remarks in the paper by Straus struck a familiar note. They could almost be quotations from our conversations.

Given this organization of the university, the interdisciplinary program faces significant problems. One solution has been to create a new department thus legitimatizing the new field within the power structure of the university. This solves one set of problems but at the same time it forces the interdisciplinary field into the mold of the departmental structure. There is a real danger that much of the flexibility and interdepartmental cooperation which are vital to the interdisciplinary field will be lost when it is made a discipline and a department unto itself.

Presumably then, there is a need to alter the university structure in order to foster interdisciplinary fields. It is not clear to me how this might best be accomplished, although it is clear that an independent budget is vital. I would note that at Penn State there are almost as many approaches to organizing interdisciplinary efforts as there are interdisciplinary programs. The Penn State experience should be valuable in providing some indication of how interdisciplinary programs might be nourished.

I would point out that to some extent the relation of departments to interdisciplinary efforts is overstated in the articles. It is important to note that in the department, or at any level within the university or society, decisions are made concerning priorities. Most departments today encompass a variety of subfields which are universally regarded as belonging to that field. Nonetheless, the department may decide to emphasize some of these subfields and to de-emphasize others. Hence, even faculty working in intradisciplinary subfields may be subject to departmental prejudices when being considered for advancement.

In some cases, departments will encourage faculty efforts which are interdisciplinary in nature. Therefore, while persons working in an interdisciplinary field often may be cutting themselves off from all chances for promotion, alternatively they may actually be improving those chances if the department recognizes this as a significant direction in which to move. Unfortunately, the latter situation is much less common and much more subject to the whims of the dpeartment and to changes in administration.

Memorandum 9:[16]

As per your request of October 3, 1974, I reviewed the papers by Robert Straus and Sidney Sternberg and have prepared a brief commentary on them.

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[16]From T. D. Larson, Professor of Civil Engineering and Director of the Pennsylvania Transportation Institute. October 25, 1974.

The papers under consideration were of particular interest to me since I have had seven years of intensive involvement with IDR (interdisciplinary research). However, even with this long time interest and a very considerable amount of study of this matter, I am not competent to judge the accuracy of the broad contentions made by the authors that society is demanding IDR and that departments are road blocks to the needed change.

First side stepping these sweeping assertions and turning to the personal level, I must say that my involvement with IDR here at Penn State has been a very rewarding experience and that my contacts with departments and colleges have been almost uniformly positive. However, this affirmative reaction may be misleading in the terms of my own career. It is my judgment, at this point, that IDR involvement has not been the optimum type of experience for one who has aspired to be department head, dean, etc., i.e., the traditional university administration career path. On the negative side, I must also confess that I have heard department heads at Penn State say that "by definition" all intercollege efforts are "less rigorous than those of the traditional departments.

Going beyond the personal level and looking at our experience as an institute, I must confess that the assembling of senior specialists who then solve major problems (like the alfalfa weevil case cited by Sternberg) is not our usual modus operandi. We have, however, had considerable success in using students from various disciplines who work under a professor (project director) who is committed to the interdisciplinary research process, but who is, in fact, basically a disciplinarian himself. I have remarked on many occasions that while we have done some excellent research perhaps our greatest contribution has not been in solving the world's problems through IDR, but rather in training students (PhD candidates in most cases) to work in a productive interdisciplinary fashion. If this is true, then, our IDR effort gets its best marks in education rather than in research!

Returning now to the papers, my most significant criticism is that they offer so little by way of solution. Straus delivers his polemic against departments, but departments are the fact of life and pressure from society will, in my opinion, not bring about early change. Sternberg points to the agriculture model, as does everyone who wants to offer a solution to an otherwise unanswerable problem, i.e., how to do research, interdisciplinary or other, and have it delivered to the public. More time should be spent perhaps in explaining the weaknesses of this model; that it is not transferable to any other cases that we know about!

Finally, if I may take the liberty of commenting on the Penn State IDR system from an overall perspective, it appears that we have fashioned here a workable system in spite of the difficulties that these authors point up. The architects of the Penn State model have been Osborn, Zook, Cunningham, Remick, et al., together with various institute directors, department heads, and deans. In other words, there has been a good deal of sharing, interdisciplinary cooperation if you will, in solving the IDR problem. Key elements at Penn State are direct University fiscal support to institutes, tenured position control by departments, good physical facilities for institutes, administrative approbation of IDR cooperation, and a positive state government attitude towards the interdisciplinary product. I feel that we have made progress that belies the doom saying of these authors.

Memorandum 10:[17]

In response to your request of October 3, I have read the papers by Straus and Sternberg. From them, I infer that the "recurring question" on which you want our thoughts is: what is the appropriate role of interdisciplinary majors, interdisciplinary research, and research institutes within the graduate program of a (this) university? Or, perhaps more challengingly: in an interdisciplinary world, what is the role of the traditional academic department? Here are a few comments (that don't come close to answering the question).

1. For most people's best efforts, there is a need for a focus, for definition. This is true for the student, and it is true for the teacher-researcher. In general, traditional departmental structures have provided this definition quite well.

2. There is a need for flexibility without disorder. In general, the non-traditional departments and majors look better on this score than the traditional ones. They may be more experimental, they may be more forward-looking, they may be less concerned about preservation of the academic status quo.

3. Today's interdisciplinary field may be tomorrow's traditional department. There are many examples: biochemistry, biophysics, chemical engineering, geophysics, political science, educational psychology, materials sciences. There is no reason to fear this kind of evolution. But when one is in a traditional discipline it often is hard to view objectively an interdisciplinary effort that seems to be infringing on one's territory. Unfortunately there also are instances in which an interdisciplinary group seems to guard its territory much too jealously.

4. Research institutes are very useful, particularly in applied research areas, because they can offer team-type responses to societal needs. They usually do this more effectively than traditional departments, in which the putting together of a research team among the faculty is a slow and often unsuccessful effort. With the current emphasis on solving problems of society, this means that institutes are likely to be the most effective fund-procurers for research. Thus they can greatly aid the academic ends of the university if they are controlled by faculty having high standards. There are of course other types of institutes that are just the opposite of the type just mentioned - i.e. essentially institutes for advanced study that offer insulation from societal needs, rather than fast response to them. These institutes are very valuable, but do not (as far as I know) cause the kinds of conflicts mentioned below.

5. Difficulties arise when institutes begin to consider themselves as more than research organizations, as more than places where people group themselves to do research. Research institutes should not attempt also to be academic departments or interdisciplinary majors. This leads to a confusion of purpose.

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[17] From Howard B. Palmer, Professor and Chairman of Fuel Science. October 7, 1

6. Thus in sum, my attitude is that we should encourage interdisciplinary academic efforts both in research and instruction. However, we need to realize that loyalties of faculty cannot be split too many ways, or they lose the focus that is needed and is normally provided by an academic department. Research institutes are to be strongly encouraged; but their purposes as specialized centers for research and scholarship must be kept clearly in mind. Institutes are not to be confused with academic disciplines.

Memorandum 11:[18]

I find that I concur with the general evaluation of the status and problems of interdisciplinary research within universities as expressed by Straus and Sternberg in their papers. However, I wish to make several personal comments and elaborations.

At Penn State after some trial and error a policy has evolved on the administration of interdisciplinary research units that requires that professorial appointments and tenure must be through the disciplinary departments in the colleges. Although this limits and somewhat weakens the interdisciplinary centers and institutes, it is a compromise that has distinct advantages. Interdisciplinary centers generally are focused upon some current societal problem for which faculty and student interest may be intense today, but may wane in the future. The policy of not making full-time, continuing, professorial appointments in the interdisciplinary research units enables the University to expand or contract a center more readily, with tenured faculty with a joint-appointment having a disciplinary home to return to on a full-time basis. Further, requiring joint faculty appointments provides greater assurance that the faculty member will be more closely in touch with the instructional and advising programs of the University, and thus, be better able to incorporate the results of his research in normal instructional programs for prompt dissemination to students. I think that this is a worthy objective and helps keep the research activities at least partially oriented towards students and instructional programs.

Based on my personal observations, I would say that the parochialism and reticence towards change of some of the departments as pointed to by Straus and Sterberg can be equally directed at the college level in certain cases. Interdisciplinary programs have far fewer problems with individual departments where a dean is committed to the value of interdisciplinary cooperation, than in those cases where the dean is not committed or is opposed (either directly or underhandedly).

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[18]From F. J. Remick, Associate Professor of Nuclear Engineering and Assistant Vice President for Research and Graduate Instruction. October 17, 1974.

The real solution to enhancing interdisciplinary academic programs is top administrative commitment backed by the administrative, financial and facility resources with which the interdisciplinary unit head is in a position to be heard and to bargain. (It is interesting to note that at this University we have a Dean of Libraries, but no Dean of Intercollege Programs.) Resources which flow to the departments through the centers result in much greater interdisciplinary cooperation than funds that flow directly to the department with only indirect verbal encouragement to cooperate. However, it is necessary to assure a balance. Close departmental ties and close administrative control help assure that the centers and institutes do not go their own way, using the resources to build autonomous empires. Although greater autonomy might better enable the units to respond to society's needs for immediate answers, there is greater risk that they might move away from the primary missions of a University, which are student focused.

Memorandum 12:[19]

I agree with the central premise that universities, most particularly public-supported universities, have a mandate to generate research applicable to the solution of human problems and to educate persons who can use research and theory in everyday real life problem-solving. However, it seems to me that both Straus and Sternberg are over-reacting against the academic department and are not realizing some of the consequences or implications of their proposed solutions or alternatives.

The (or a) major reason for inter-disciplinary research (and teaching) is not to support policies of any national department or agency as Sternberg implies (p. 2). Nor is inter-disciplinary research the only possible response of a university to meet the problems created by change. Emphasis on "knowing" rather than "searching" (Straus, p. 896) is a criticism of educational philosophy, not of departmental organization. Stronger arguments for inter-disciplinary or multi-disciplinary research and teaching can be made. Lessening the "power" of departments may be useful in some universities, but more so at other institutions where departments have traditionally been highly autonomous and jealous of outside interference than at Penn State where authority and responsibility have already been transferred to "higher" levels.

In assessing the alternatives several factors must be considered:

1. Any organizational structure tends to build in self-maintenance mechanisms. This is as true of multi-disciplinary institutes or centers as it is of departments. Outworn organizational structures, like ad hoc committees, find ways to extend their life span beyond their original mandates or social usefulness.

2. Professional or vocational standards, regulations, and requirements operate to maintain the status quo with more force than departments do. Accreditation (of engineers, psychologists, etc.) may be resisted by a

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[19] From William M. Smith, Professor of Rural Sociology, October 22, 1974.

multi-disciplinary or inter-disciplinary set up but unless the outside professional standards are met the products of the system (graduates) meet closed doors when they seek employment in established fields.

3. The university education process conditions or socializes students and faculty to identification with a "discipline" or area of scholarly study, seldom to a department. This is related to point 2 and has always plagued university administrators who must maintain a functioning work force made up of individuals whose central commitments are outside the system. A chemist couldn't care less whether he "professes" chemistry in one department or another as long as he can gain the recognition of his peers in chemistry. This motivation may even override financial considerations. And professional organizations must be sold on institutes or multi-disciplinary programs if universities are to promote them. Incentives on campus are less often the barriers to ID research than is the recognition of professional peers.

4. Participation in ID research is hindered by budgeting practices, not necessarily related to departmental organization. With the current stress on "accountability" this problem may increase. Where "outside" funds as "soft monies" are available faculty often find it difficult to transfer funds from one department to another or from one budgeting category to another to meet the needs of the ID situation.

5. The question of "Who gets the credit?" sometimes impedes ID efforts. The supervisor may raise this question or the faculty member himself, eager for peer recognition, may want to be sure that he is not going to be involved in a project for which others will receive the major pay-off. Some ID divisions pick the brains of traditional department faculty, use the ideas, contacts or resources thus gathered to gain funds or carry out programs, and then forget the source genesis of their ideas.

6. Applying research to social or public problem-solving without theory is folly and wasteful in terms of resources and results. It is difficult for the ID structure (e.g., college) or for the person working in an ID framework to keep abreast of the several disciplines involved. The recourse then is to assume a trouble-shooter, fire-extinquisher, solution-giver role. Both research and teaching become watered down and the "customers" are left with no resources (principles, generalizations, theories) with which to tackle ensuing problem situations.

7. In addition to the factor of identity or commitment mentioned in #3, ID research or teaching demands a different level of communication than does research or teaching in one segment of a discipline. It makes an economist no less an "economist" to be able to translate his concepts to a businessman or to a psychologist. But neither ID institutes nor academic departments have tackled this. Even the Cooperative Extension Service, Sternberg's model, had tended to assume that a person can be re-conditioned after college graduation to be able to communicate with clientele. But this requires continuing in-service training (i.e., substituting "centers" for departments will have little chance of success unless effective communicators who are problem-centered rather than discipline-centered are hired).

In conclusion, here is a personal note. The above reactions and comments come from about 40 years of experience in research, teaching, and extension almost all in an ID structure. Working with professional colleagues from other disciplines is a salutary but often difficult task. It challenges one to question his own concepts, generalizations and basic premises. (It is parallel to working in another culture.) It makes one work continually on communication, never taking it for granted that the other team member completely understands. (At Cornell one ID team had two years of discussion before they could even formulate a research proposal.)

The experiences of the College of Human Development here and of Home Economics on many campuses are examples of the ID dilemma. (To a lesser extent so is Agriculture.) Both are inter-disciplinary or multi-disciplinary in structue and orientation. Both include faculty with professional "identity" problems. Without strong administrative (financial) support they have little "clout" or power in University decision-making. Where certain departments or ID divisions have been effective over time there have usually been evidences of shared commitment to program development, effective democratic leadership, and/or competent faculty whose self-concepts or professional stature can withstand peer pressure and who can gain satisfaction from the process of helping people solve their own problems, from applying theory to practice, or from the development of service programs. At Penn State, it seems to me, before setting up more ID research (or teaching) structures, a more direct effort should be made toward integrating various parts of the university already functioning. Examples of the need are numerous. They do not necessarily imply re-structuring departments but they may require administrative support and mandate for continuous (not sporadic) work across various lines. (e.g., Extension and Continuing Education; Health in Colleges of HPER, H DEV. and Agr.; Extension, Research and R.I. in Agriculture; Recreation in Agr. and HPE & R.)

ANALYSIS AND ILLUSTRATION

Twelve memoranda have been quoted to provide a basis for appraisal of interrelationships among individuals and organizational structures involved with research on a university campus. From these memoranda it is practicable to extract topics which recur in discussions and decisions affecting the administration of academic research. The following pages will be devoted to this purpose. They will contain an enumeration of topics in "short-title" form, with illustrations and expansions based on memoranda which have been quoted and on others which hitherto have not.

No attempt will be made to include all references in all memoranda to any topic. Where one reference expands, contradicts, clarifies, or otherwise contributes to the significance of another, both will be noticed - subject, of course, to inadvertant oversight. The memoranda will not be used as if they were understood to be ballots on an issue. The implication of balloting would be quite spurious under the circumstances.

This procedure necessitates interpretation by an individual of statements of some complexity; for this reason it cannot produce a result for which the authors of the memoranda can be held responsible. The topics themselves are subject to revision. They are influenced, of course, by the emphases of the target articles, and might assume quite different forms in other contexts. They have at least a tentative legitimacy, however, and possibly more than casual utility. They appear below as headings of eight summary sections, as follows:

A. THE UNIVERSITY AND SOLUTION OF SOCIETAL PROBLEMS
B. INTERDISCIPLINARY FORMS AND FUNCTIONS
C. AUTHORITY IN THE UNIVERSITY, CENTERS OF INFLUENCE
D. DEPARTMENTS AND DISCIPLINES, FORMS AND FUNCTIONS
E. THE PREROGATIVE OF PROFESSORIAL APPOINTMENT
F. THE AGRICULTURAL MODEL AND APPLIED RESEARCH
G. EQUILIBRIUM OF ADMINISTRATIVE POWERS
H. RESEARCH AND INSTRUCTION

A. THE UNIVERSITY AND SOLUTION OF SOCIETAL PROBLEMS -

In Memo No. 1 above the author questions what he calls the "first premise" of the Straus and Sternberg articles--

> that a University's overriding concern is or should be solving society's current pressing problems, . . .

This premise prompts a number of comments throughout the correspondence. For purposes of definition they are divided below according to differences of emphasis which they represent, interpreted in general statements (underlined), and illustrated by selective quotations from the memoranda. In this instance the division is in terms of the impact of the "premise" as it affects -

1. The individual scientist -

   The scientist's value is dissipated if his services are required for problems which do not engage his particular expertise.

   Memo No. 3 above: ". . . the physics input required by interdisciplinary research is often on the technician's level and does not warrant faculty participation."

2. The university as a whole -

   The university is capable of societal initiatives of its own.

   > ". . . internal changes within the University structure should be made. It is questionable, though, whether these changes should be made solely on the basis of a changing society. It would be preferable if the universities could, in fact, effect changes which would permit them to be the origin of the basic attitudes and philosophies which bring about changes in our society."[20]

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[20] From C. Drew Stahl, Professor and Chairman of Petroleum and Natural Gas Engineering, October 3, 1974.

3. Instructional programs -

Research in a university should have an instructional dimension.

Instruction in a university should have potential for research.

"I am greatly concerned about the effort to protect intellectually inadequate students, and its cost. I am experiencing this in teaching an undergraduate course of nearly 400 students who come from over 30 majors."[21]

4. Social and humanistic areas of study -

Consideration of university organization requires appropriate regard for all areas of university activity.

"Sternberg is geared, obviously, to think only in terms of the physical environment. I would have thought that even the most naive critic--or perhaps 'interpreter' is a wiser word here--of the ills of America today was aware that there is as much, if not more, wrong with the psychological environment than the physical. . . . At any rate, Mr. Sternberg's thoughts have much to do with air pollution and nothing to do with political or spiritual pollution."[22]

5. Disciplinary identity -

The academic disciplines constitute, each in its kind, a stage of human achievement; they should be subject to growth, and change, but not to abandonment.

"I'm sure most of us would have some negative reactions to the concept implied in Sternberg's article relating to priority areas being established at the national level and then individual scientists having to bend to those priorities to gain funding. However, I think we must be realistic and understand that this will continue to happen to some extent. Hopefully, over some reasonable period of time, these priorities will have a relationship to real needs and researchable problems. It is our responsibility as a university and as individual scientists to consider these national priorities but also 'to be true to our branch of science.' In other words I am saying that federal funding is a reality and we must learn how to deal with it. We must not allow the federal funding areas to become the only (or even the dominant) force in dictating research emphasis."[23]

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[21] From Edward G. Buss, Professor of Poultry Science, October 30, 1974

[22] From Lowell L. Manfull, Associate Professor of Theatre Arts, October 17, 1974.

[23] From Billy R. Baumgardt, Professor of Animal Nutrition and Head of the Department of Animal Science, October 29, 1974.

B. INTERDISCIPLINARY FORMS AND FUNCTIONS -

In Memo No. 7 above the author, the director of a research institute, offers a description of interdisciplinary research both as it might be (as he would prefer to have it) and as it usually is -

> "In interdisciplinary research, propositions from several disciplines are blended together to form the hypotheses for study. Only on rare occasions does this integration actually take place. More often the conceptual framework in team research is a tossed salad of propositions--each construct maintaining its identity with the parent discipline. In this latter case, the chief benefit is coordination of the work so that all efforts are directed toward the solution of a common problem."

This topic recurs throughout the correspondence. Summary will again be by general interpretive statements with illustration from the memoranda. In this instance, however, division must be in terms of a variety of meanings of the term *interdisciplinary* which are regarded as salient from the points of view that are represented.

1. Attitudes toward interdisciplinary research -

Interdisciplinary research has been and continues to be a commonplace of university experience.

"I don't know anyone who is opposed to collaborative work across disciplines."[24]

Departments and colleges pose no necessary threat to interdisciplinary collaboration.

"I have never encountered an impediment to research because it was interdisciplinary. Most of my research involves collaboration between the colleges of Liberal Arts and Science, and this fact has presented no problem whatsoever."[25]

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[24] From Frank Clemente, Associate Professor of Sociology, October 29, 1974.

[25] From Bennett Dyke, Associate Professor of Anthropology, October 8, 1974. To a similar effect W. I. Thomas, Professor of Agronomy, cites as currently active in the College of Agriculture, of which he is Associate Dean for Research, the following (October 9, 1974):

61 research projects in which project leaders belong to the faculties of two or more departments.
9 research projects in which two or more project leaders belong to the faculties of different colleges within the University.
55 research projects involving cooperation with institutions in other states.

Interdisciplinary organizations may imply managerial leverage.

"I grant the premise that Interdisciplinary Research has both potential and real merit. Nevertheless, it appears to me that in the wings there is a bit of heavy handed pressure to accept IDR as the only viable approach for Universities to follow. It is interesting that the only 'models' advanced by both Straus and Sternberg are in the areas of science, specifically medicine and agriculture. I think it is simplistic to generalize from these two areas to what we presently call a University, despite the fact that Universities have been in the forefront of developments in these areas.[26]

Special value does not attach to interdisciplinarity per se, but to interdisciplinarity under certain conditions.

". . . newly emerging fields may be appraised in terms of the following characteristics:

a. developments in the essential nature of the pertinent subject matter,
b. shared need for expensive facilities,
c. patterns of demand by society as indicated by availability of employment and funding,
d. ready strength in the major components of the new mixture as they exist in the institution as a whole,
e. a synergetic relationship between opportunities for research and opportunities for graduate instruction."[27]

2. Interdisciplinarity and administrative structures -

Interdisciplinary research is independent of administrative structures.

"Research programs which cut across departmental lines achieve success through the voluntary association of the faculty members involved. . . . Where research is the object, I doubt that a formal structure would enhance this voluntary association. Such voluntary associations have provided the needed opportunities, and to my knowledge have posed no serious problems."[28]

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[26]From Arthur W. Heilman, Professor of Education, in charge of the Graduate Program in Developmental and Remedial Reading, October 15, 1974.

[27]From Rustum Roy, Professor of the Solid State and Director of the Materials Research Laboratory, December 3, 1974.

[28]From Kenneth Goodwin, Professor of Poultry Science, October 25, 1974.

Interdisciplinary research requires appropriately structured administrative support.

"I agree that ad hoc teams do not work well. . .interdisciplinary programs work best in an interdisciplinary college."[29]

"It is my experience that interdisciplinary programs within a single college have the best potential for success. This is particularly evident in colleges which are essentially interdisciplinary in nature, such as the College of Earth and Mineral Sciences."[30]

3. The purposes of interdisciplinarity -

Cross-disciplinary organizations may serve purposes other than research.

"Since the Laboratory Animal Resources Program performs a service function it differs from most of the other intercollege programs. However, I believe, our experience with it is an excellent example of a necessary University-wide cooperative effort that only can be accomplished at an intercollege level."[31]

Interdisciplinary research may or may not be applied research; applied research may or may not be interdisciplinary.

"One of the papers that you forwarded to us presumes that interdisciplinary research and applied research are one and the same. While I would agree that much applied research is interdisciplinary and must draw upon expertise from a variety of sources, there is applied research based upon a single discipline."[32]

"There are of course other types of institues . . . - i.e. essentially institutes for advanced study that offer insulation from societal needs, rather than fast response to them." - (From Memo No. 10 above)

"Sternberg is seeking solutions to operational problems which I agree often require interdisciplinary groups and the team approach. I think this sort of thing can be done on the University campus, but it should not be done at the expense of not encouraging the basic disciplines to do basic research. Furthermore, some problem solving activity. . .should best be done elsewhere than on a university campus."[33]

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[29]From Robert M. Griffin, Associate Professor of Environmental Planning and Chairman, Graduate Program in Regional Planning, November 4, 1974.

[30]From C. Drew Stahl, Professor of Petroleum and Natural Gas Engineering, October 3, 1974.

[31]From Frederick G. Ferguson, Assistant Professor and Director, Centralized Biological Laboratory, October 26, 1974.

[32]From Max D. Richards, Professor of Management and Assistant Dean for Graduate Programs, College of Business Administration, October 16, 1974.

[33]From Paul H. Rigby, Professor of Business Administration and Director, Center for Research, October 28, 1974.

C. AUTHORITY IN THE UNIVERSITY, CENTERS OF INFLUENCE -

In Memorandum No. 6 above the author makes a clear and unambiguous statement of his opinion on where responsibility lies in the hierarchies of universities -

> "I believe that the administrative officers of a university should make decisions effecting the life and death of programs. If they are unwilling to do so, or if their record is bad, they should be replaced. The making of decisions is what they have been trained (and are paid) to do."

With regard to the creation and decommissioning of inter- or extra-collegial programs this opinion may be fairly widely shared. However, there is among the respondents a variety of attitudes with respect to the location of effective authority for academic decisions. In the following summary notes no attempt will be made to distinguish between those who regard authority with approval and those who regard it with disapproval or neutrality. The division will discriminate only the organizational loci with which determinative power is associated; with individuals, departments, colleges, central administrative offices, or with centers of influence external to the university.

1. The individual researcher -

> <u>The scholar who declines collaboration will have his wishes respected in proportion to the degree of his success</u>.
>
> "There are some researchers who work independently and it is almost impossible to get them to work on an interdisciplinary project. I think that the only way to get effective work from these individuals is to let them work by themselves, since even though funding and other directives were mandatory I question whether they would effectively do interdisciplinary research."[34]

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[34] From W. I. Thomas, Professor of Agronomy and Associate Dean for Research, October 9, 1974.

2. The departments -

In a large university departments have the critical organizational magnitude at which self interest and professional interest most nearly coincide.

"I disagree with Straus in the following respects: (i) I do not find the changes likely during the next 15 years to be an extrapolation of those of the past 15 years; in fact, I think they may very well represent a return to the pre-1960 position in many respects, (ii) I do not think that contraction of higher education need involve any threat to academic standing or academic freedom; indeed it very likely will be conducive to both, (iii) Although academic departments certainly evolve with time, I see no great present need for radical revision, or evidence that the departmental structure is dissolving, (iv) My own experience is that the departmental structure has not acted to inhibit interdisciplinary activity, but the contrary."[35]

"For the past two years I have served as chairman of the graduate instructional program in Solid State Science here at Penn State. This is the first and one of the largest interdisciplinary programs, but the chairman has almost no power. I cannot make faculty appointments, and most department heads don't ask my opinion when they make new appointments or grant tenure. We have survived because of the good will of two men: the Director of the Materials Research Laboratory and the Head of the Materials Science Department. Other department heads have not cooperated, and a few have been openly hostile, probably because they regard our graduate program as competition for their own. The situation has grown worse during the past few years because of the competition for research money and student credit hours."[36]

"It seems to me that the makeup of interdisciplinary research teams needs change from time to time just as the makeup of a department should change. Therefore, why not build the organizational pattern around the department concept but provide means of evaluating these organizations at least every five years."[37]

Departmental structures are reflected in and reinforced by national professional associations.

". . .there is order and value in a stretchable departmental system if the 'fringes' are allowed to extend and the area of activity allowed

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[35]From Frank A. Haight, Professor of Statistics and Transportation, October 7, 1974

[36]From Robert E. Newnham, Professor of Solid State Science, October 24, 1974.

[37]From Billy R. Baumgardt, see note 23 above.

to remain flexible. Professional societies form the basis of common interest and provide a mechanism for information exchange and also provide, in large measure, the literature for graduate education via the professional publications that are sponsored. Here a useful peer review process (frequently world wide) is built in because of the usual requirement for reviewer approval of submitted manuscripts. But even the societal system, which departments tend to imitate, must remain flexible and facilitate change." (From Memo No. 7 above.)

3. The colleges -

Although colleges seldom have the homogeneity of departments, college deans often have great influence.

"With reference to the 'power base,' it is felt that this is departmentally oriented at our University. Though one frequently wonders whether one should say it is college oriented."[38]

". . .music education is currently involved in a multi-disciplinary approach to teaching the arts which involves four departments in three colleges at Penn State. Curiously enough, neither faculty nor department heads have encountered any difficulty until we reach the dean's level."[39]

"It is essential, for fiscal reasons, not to add further to the existing administrative load. There should be one administrative structure, and programs which cut across that structure should not have budgets, offices, and similar administrative function."[40]

"Based on my personal observation, I would say that the parochialism and reticence towards change of some of the departments as pointed to by Straus and Sternberg can be equally directed at the college level in certain cases. Interdisciplinary programs have far fewer problems with individual departments where a dean is committed to the value of interdisciplinary cooperation, than in those cases where the dean is not committed or is opposed (either directly or underhandedly)." (Memo No. 11 above)

4. Central administrative offices -

Through its control of budget making, disbursements, and accounting, central administration holds determinative authority in academic decisions.

". . .interdisciplinarity and multidisciplinarity are both 'good' and 'natural'; but departmental rigidification, whatever the initial impulse,

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[38]William J. Moroz, Professor of Mechanical Engineering and Director of the Center for Air Environment Studies, October 18, 1974 (Previously quoted aobve, p. 6)

[39]From Warren E. George, Professor of Music Education and Department Head, October 29, 1974.

[40]From Kenneth Goodwin, Professor of Poultry Science, October 25, 1974.

is continued and change is resisted because the academic superstructures foster this process, and, indeed, for their own reasons, protect it. . . bureaucracies by definition desiderate tidy compartments, which is what departments are."[41]

". . .in peacetime the problem which confronts us is whether to be abstract, problem oriented, or some combination of these two. One should not expect every institution to arrive at the same conclusion, however, each institution should, if it is to manage its affairs properly, face this problem fairly and squarely, give it an honest answer, and operate in accordance with the decision. If the institution chooses to try to operate under a combination of fulfillment of the abstract and the problem oriented, we have exactly the kind of problem which shows up at Penn State. . .Penn State has the "abstract" governing the problem oriented activities of the University. The abstract makes the rules, and it leaves the problem solvers in a humanly untenable situation to be at peace with their role in the University as second-class citizens."[42]

5. Influences external to the universities -

Organizations committed to research are directly affected by funding policies of governmental agencies.

"I have found that the greatest obstacle to any kind of research is the present granting system for distributing funding. The amount of my time spent trying to maintain a continuous program under this system is staggering. Since the kind of interdisciplinary research Sidney Sternberg is considering is subject to change with very short notice, as we have experienced recently with the energy crisis, the maintenance of quality control in any kind of continuous program could be a nightmare. It is my opinion that Mr. Sternberg's analogy with research in Agriculture must also include continuous long term funding such as is available in Agriculture."[43]

"The discipline-oriented activities of the University may not be the major reason that interdisciplinary research is not more extensive. Rather, it may be the organization of research support. In the case of agriculture, support was focused in one department of the government which has been able to develop relationships with organizational units in the university and to develop those units. In the case of research on problems of pollution, etc., governmental agencies may have their own disciplinary bias that prevents development of similar kinds of colleges. Thus it may not be the organization of universities that engenders a lack of interdisciplinary support but the organization of the fund granting aspects of

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[41]From Walter Donlan, Associate Professor of Classics, October 31, 1974.

[42]From John C. Johnson, Professor of Engineering Research and Director of the Applied Research Laboratory, October 14, 1974.

[43]From John M. Norman, Assistant Professor of Meterology, October 16, 1974.

government. Centralization of research efforts in government prevents the long-term development of close organizational ties into the universities."[44]

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[44]From Max D. Richards, Professor of Management and Assistant Dean for Graduate Programs, College of Business Administration, October 16, 1974.

D. DEPARTMENTS AND DISCIPLINES, FORMS AND FUNCTIONS -

In Memorandum No. 10 above the author describes departments serving a useful function adequately -

> "For most people's best efforts, there is a need for a focus, for definition. This is true for the student, and it is true for the teacher-researcher. In general, traditional departmental structures have provided this definition quite well."

Without departments the university would be compelled to produce other discriminators for use in organizing its announcements and to paint on office doors for the guidance of students and visitors. This minimal function of departmentalism is alone enough to account for its stability in most universities. Considered in this perspective, colleges are departments at a second level of generalization. Departments are administratively convenient, and as conveniences they provoke no significant reaction either pro or con.

Conflicts and tensions arising about departmental structures derive chiefly from their participation in concepts implied by the terms *discipline* and *service*. For purposes of summary,

1. *department* will be understood in the following notes to mean *administrative organization;*
2. *discipline* will be understood to mean an *intellectually integral body of knowledge;*
3. *service* will be understood to mean *maintenance, development, and dissemination of a specified body of information and skills, often but not always in the interests of a specified clientele.*

1. Departments -

Departments reduce institutional confusion.

"I do not see how departments, per se, could be eliminated without the end result being chaotic; the structure is not ideal, but at least in the fine arts, I cannot see any substitute. Neither can I see any substitute for people with specializations. . . . I see no substitute for the specialist. Actually we need more and better ones."[45]

All administrative agencies are vulnerable to distortion by aggressive parochialism, departments no more nor less so than others.

"At no time in my academic career have I found the departmental structure an impediment to working with people from other disciplines. . . ."[46]

"I am asked to believe that there is a department in the humanities in the U.S. that denies its candidates opportunities to cross and combine disciplines. I suppose there must be such departments, but in my area (medieval Spain), not only here but in so-called 'literature' departments across the country, numbers of students cross into philosophy, social history, religious history, etc., not just to take a course or two, but to utilize what they learn in their research."[47]

2. Disciplines -

The academic disciplines are the indispensable foundation on which intellectual enquiry is based.

"The Straus article is a gross misrepresentation of the role of academic disciplines. They do not 'preserve anachronistic identities,' 'enforce absolute compartmentalization of teaching' or 'discourage formal research and teaching activities that cross disciplinary lines'. Academic disciplines have the following advantages:

a. They are the major vehicle for the application of rigorous criteria to specific subject areas or problems.
b. Their rigor provides a basis for the evaluation of research.
c. They give a variety of perspectives to a particular problem.
d. They become the building blocks for interdisciplinary work.
e. They enable the development of a creative interplay between the analysis of the whole and of its parts.
f. They contribute to the development of low level and medium level generalizations.

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[45] From Robert W. Baisley, Professor of Music and Department Head, October 14, 1974.

[46] From Helen A. Guthrie, Professor of Nutrition, November 5, 1974.

[47] From H. Tracy Sturcken, Professor of Romance Languages, October 31, 1974.

"In short, because of their rigor they provide a basic standard against which to judge the validity of proposition, thesis, and generalization. They do not discourage interdisciplinary approaches but make major contributions to such approaches."[48]

"Straus says there is nothing intrinsically permanent about disciplines. Surely we will always have history and the need for a history department. The material which the department is concerned with will undoubtedly change with time, but in my view the nature of the discipline is rather permanent. On the other hand, his observation probably holds true for many departments concerned with technology."[49]

"Interdisciplinary research has been traditional in some of the so-called disciplines, such as nutrition, physiology, and genetics. I cannot believe that Dr. Sternberg is familiar with the variety and diversity of courses taken by students in Agriculture and in the above named disciplines."[50]

3. Departments and disciplines -

Administrative departments and their corresponding academic disciplines are not necessarily or permanently coextensive.

"Universities, and their historic or contemporary counterparts, have always been organized so that the administrative structure paralleled the academic structure, i.e. the administrative units, such as departments, are, or were, responsible for defined parts of knowledge. Formerly, inconsistencies were rare or impossible. The definitions of chemistry, botany, physics and zoology, for example, were simple and unambiguous. Between the subjects were great discontinuities of ignorance which kept the subjects conveniently and clearly in indisputable categories. With the advance of knowledge generally, but especially in science, the gaps disappeared and the subjects first became contiguous and then partially confounded. The parallelism between the content of the subjects and the units of administration became less and less clear. Areas of knowledge and competence arose such that the old categories which once were clear became only approximations - some of the new knowledge was part of two old categories. Courses and research originated which were equally relevant to, for example, physics and chemistry, botany and zoology, astronomy and physics. In some instances, new categories were recognized and were given administrative identity e.g. departments of biophysics and biochemistry. In other instances, new interdisciplinary programs were created, programs which had academic consistency but did not need administrative support. The problem would now seem to be that of deciding to what extent universities should attempt to provide each area of knowledge with an administrative counterpart."[51]

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[48] From Stanley A. Kochanek, Professor of Political Science, October 31, 1974.

[49] From Barnes W. McCormick, Professor of Aerospace Engineering, November 7, 1974.

[50] From Edward G. Buss, Professor of Poultry Science, October 30, 1974.

[51] From Joseph G. O'Mara, Professor of Botany and Head, Department of Biology, October 23, 1974

4. Service -

Some stable departments are defined in terms of mission and without explicit reference to academic disciplines.

"It is probably true that the make up of the 'department' should periodically change. Disciplines do shift and merge over time, and discipline is not the only criterion for organizing a department. My own, Agronomy, is a good example of a department whose definition tends to be on the basis of commodity and/or service rather than of discipline. From the standpoint of discipline, we are clearly a multidisciplinary unit in which persons representing such diverse disciplines as chemistry, physics, cytology, and ecology work together on problems of common interest."[52]

"Most departments in colleges of agriculture may be somewhat unique in the general university system in that we have a traditional clientele (a segment of society which will apply our findings) to serve."[53]

5. Discipline and Service -

Departments are designed to be both disciplinary and serviceable, although the two functions may be honored in varying proportions.

"When an applied college such as Agriculture or Business involves itself in the solution of problems of the constituency which it serves, it at the same time develops expertise which duplicates that of the disciplines in the sciences and social sciences."[54]

". . .business schools, like a number of professional schools, have programmatic goals as well as disciplinary goals, and the two tend to conflict. Often the solution in some of the better schools is . . . a matrix structure. You have program directors and faculty chairmen. The two interact in meeting the various objectives of the college. Obviously there can be conflict between the two. A solution is a collegial model with shared authority where neither has veto power over the other."[55]

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[52]From James L. Starling, Professor of Agronomy and Department Head, October 21, 1974.

[53]From Billy R. Baumgardt, see note 23 above.

[54]From Max D. Richards, Professor of Management and Assistant Dean for Graduate Programs, College of Business Administration, October 16, 1974.

[55]From Paul M. Rigby, Professor of Business Administration and Director, Center for Research, October 28, 1974.

6. Departments and program review and/or evaluation -

Review of departmental programs by intra-institutional officers or committees is intrusive and ill-advised.

"Often the only individuals fully equipped to evaluate a program and its personnel are those immediately involved in the program itself."[56]

"While I think that departments need to be responsible for the work that they are undertaking, I do not think that another part of the University is necessarily the best judge of that work. As long as there are adequate external reviews. . . , it does not appear to me necessary, in fact it is duplicative, for internal reviews to be undertaken."[57]

"It is clear that the regular, periodic 'review and evaluation' of academic personnel and departments has served and continues to serve to reinforce the attitude of isolation within departments. It is my opinion that most internal reviews and 'evaluations' are counter-productive and should be abandoned."[58]

Review of departmental programs by intra-institutional officers or committees is constructive and necessary.

". . . self evaluative processes . . . are a step in the right direction. An integrated planning-budgeting-evaluating system would be far superior, however. If properly designed, it need not infringe upon 'academic freedom,' unless this were defined as complete freedom from all responsibility, which I find repulsive."[59]

"Intrauniversity review of its departmental programs must continue. I . . . suggest that one of the guides for development of new programs and retention or abolition of old ones be trends in enrollments . . . this factor reflects 'sensed' need by parents, students, and the public. . . . Timidity in terminations should not be honored."[60]

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[56]From Lowell L. Manfull, see note 22 above.

[57]From Max D. Richards, see note 32 above.

[58]From C. Drew Stahl, see note 20 above.

[59]From Henry D. Gerhold, Professor of Forest Genetics, October 7, 1974.

[60]From Edward G. Buss, see note 21 above.

"Straus objects to periodical review. . . . Having undergone several reviews and currently preparing for the Graduate School Review, I think my Department has benefited from them. However, in order to be effective, the reviewers must have good guidelines and have some experience in reviewing. I think that a scientist and educator who has established goals and approaches to reach these goals benefits from outside opinions and criticism."[61]

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[61]From Felix L. Lukezic, Associate Professor Plant Pathology, October 24, 1974.

E. THE PREROGATIVE OF PROFESSORIAL APPOINTMENT -

One of the Memoranda partially quoted above[62] remarks on the crucial issue of appointments, promotions, and award of academic tenure as follows:

> "The comments in the Sternberg proposal regarding the rewards for participating in interdisciplinary education and research programs are quite appropriate. Department attitudes are frequently restricted to very specific areas, to the extent that application of a talent in these areas to societal problems is not regarded as being of the same caliber as work in the departmentally identifiable area."

This is the hinge point on which administrative decisions with respect to the relationships between collegial and extra-collegial organizational structures are understood to turn.

Beyond this one statement, no further interpretative generalizations will be ventured in this section of the summary. The quotations below illustrate a number of points on the spectrum of opinion with regard to the problem in general, although the degree to which any of these points might be effective in consideration of a particular scientist for appointment or other recognition cannot be stated in general terms. The order of arrangement of the quotations, based on subjective impression, is from bland to explosive:

> "I think that the case that faculty members are rewarded 'primarily on this work being viewed as contributing to the goals and images of their departments' is overstated. Against considerable pressure to do otherwise, I have resisted the strict definition of program and goals for my department."[63]

> "The notion that a researcher is discriminated against or otherwise disadvantaged in his own department because he participates in inter-disciplinary research is exaggerated and overgeneralized in both papers. I know of no one in the Psychology Department who has suffered in any way for such activities. On the contrary, one is usually encouraged to work on worthwhile interdisciplinary problems."[64]

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[62] See note 7 above. William J. Moroz, Professor of Mechanical Engineering and Director, Center for Air Environment Studies, October 18, 1974.

[63] From James L. Starling, see note 52 above.

[64] From John M. Warren, Professor of Psychology, October 7, 1974.

"In order to effect a strong environmental engineering program, we comprised a committee of people from Civil, Mechanical, and Nuclear Engineering Departments. Not only the members of this committee, but other faculty members with similar interests and backgrounds have worked on this curriculum. They have taught courses and advised students; yet several of them feel that their activities related to this field of engineering are not recognized by the chairmen of their departments. I frankly hope that this is a myth and that in general good work is recognized wherever it is. It is true, however, that a person with interests more closely allied with his administrator, regardless of level, finds the administrator better able to evaluate his work."[65]

"Certain administrative regulations and decisions have created a climate in which it is difficult for research institutes to flourish. In particular, some of the restrictions and compliances with regard to hiring practices are most difficult to live with. We cannot hire a research aid without going through a lot of Mickey Mouse, but at times our projects require just such a position. We are given notice only a few weeks in advance of mandatory increases in salary for research assistants, yet these positions are generally funded through research contracts with outside agencies and there is no opportunity to renegotiate salary payments. Moreover, no funds are made available to cover mandated increases.

"Straus shows keen insight into the problem through his statement. . . that advancement, tenure and other rewards are judged principally on the basis of the individuals' contributions to enhance the department. While I, personally, have been fortunate in having very understanding Department Heads, others in our Institute have not. There is ample evidence, I believe, at Penn State to indicate that in some cases there has been discrimination against an individual when it comes time for promotion, tenure, or salary increases, because of his involvement with research activities at the Institute."[66]

"Until search committees are geared to look on 'applied research' and group research as meritorious. . .it is almost academic suicide for a promising young faculty member to put his efforts in this area."[67]

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[65] From Otis E. Lancaster, Professor of Engineering, October 23, 1974.

[66] From Hays B. Gamble, Associate Professor of Agricultural Economics and Associate Director, Institute for Research on Land and Water Resources, October 18, 1974.

[67] From Helen A. Guthrie, Professor of Nutrition, November 5, 1974.

"I object strongly to Sternberg's position that rank and salary increases are awarded to 'those who follow the path of individual research.'. . . This has never been the case in my department and to my knowledge, in my college."[68]

". . .we now have several parochial disciplines which are controlling the very nature of the institution that was established [under the land Grant Act] to operate in another manner. The result is that those who are carrying out missions of the nature of the original institution now find themselves in second rate citizenship positions in the university; i.e., faculty who are oriented to service to others, rather than to themselves, are given second rate terms of employment."[69]

"In 1967, the then Provost of Penn State University made a unilateral decision on academic matters without any consultation with any faculty group. Ostensibly to avoid confusion, he created chaos. First, he put the interdisciplinary Solid State Technology program into a college 'for administrative purposes.' Second, he increased the separation of the interaction between the Materials Research Laboratory and Solid State Technology, and insisted on separate chairmen for the two. Third, he took a massive retrogressive step: he eliminated the power of the interdisciplinary units to appoint faculty. He forced the affiliation of all the faculty and their tenure into departments and colleges."[70]

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[68]From Donald V. Josephson, Professor of Dairy Science and Department Head, October 31, 1974.

[69]From John C. Johnson, see note 42 above.

[70]From Rustum Roy, see note 27 above.

F. THE AGRICULTURAL MODEL AND APPLIED RESEARCH -

In Memorandum No. 2 above the author discusses the Agricultural colleges as models for interdisciplinary research aggregates in general, and in the following terms:

> "Mr Sternberg speaks in glowing terms of results achieved by the agricultural research and technology system since passage of the Land-Grant Acts. He presents this system as a model for interdisciplinary achievement in universities. What he does not say is that the Land Grant Acts secured long-term continuing funding, the responsibility for management and control of which was broadly vested in the universities themselves. Several attempts have been made during the last ten years to get through Congress a law establishing similar support for university research of various kinds; two attempts have failed in the last five years to establish research and educational programs in mining and related mineral industries with continuing Federal Government funding, and with matching funds from each of the State Governments, just like the Land Grant programs in Agriculture. This speaks loudly for the greater degree of anti-intellectualism prevailing in Congress and the Executive during the latter half of the Twentieth Century than prevailed in 1862 when the first Land Grant Act was passed."

Recommendation of the agricultural model in the target articles calls special attention to what some of the respondents refer to as "fire fighting," the readiness of agricultural researchers to deal with emergencies such as a sudden infestation of destructive aphids. A parallel mode of recommendation, but one of markedly different implications for research administration, emphasizes the steady development over the term of more than a century of massive capacity to produce food and fiber on a national scale. The second emphasis is reflected in many of the memoranda, including those excerpted below.

Here again the quotations are ordered under a single general interpretative statement:

> Throughout the history of the Land-Grant Acts the interaction of Agricultural Colleges and Research Stations with their collegially organized host universities has on the whole been mutually advantageous and productive.

The ordering of the following quotations is in terms of progression from the most reluctant to the least reluctant acceptance of the agricultural model as applicable to interdisciplinary research in other fields. The ordering is based on subjective interpretations of the memoranda.

> "The obvious difficulty here is that federal funding, while all well and good, tends to be rather soft. The problems of society and the corresponding federal monies for their solution are often ephemeral. To restructure the university for such support would hardly be prudent. Alas, in our own time we have seen the universities overrespond to such problems."[71]

> "The choice of agriculture schools as a possible model for interdisciplinary research is curious and contradicts the picture of conventional departments as strongholds of paranoid protectionism. Agriculture schools generally have the same sort of departments as any other division of the university. If they have been relatively successful in applied research it is probably because they have an assured source of research funds, and funds continue to be available even if no major advance has been made during the time given for most sorts of grants.
>
> "Agriculture schools may in fact provide a useful model for the management of applied interdisciplinary research. But the useful principles may better be sought in the arrangements for funding research than in the formal structure of the departments."[72]

> "Sternberg goes a little overboard in his approach to interdisciplinary research when he suggests the possibility of organizing professional schools within the context of today's industries, such as schools of petroleum, plastics, coal, etc. His implied assumption that Colleges of Agriculture are an unqualified success is somewhat overstated but nonetheless has a point, that viable alternatives to what we are doing in agriculture might very well be tested in other fields of science. We in agriculture have our problems too and there is still plenty of room for improvement in the area of interdisciplinary cooperation."[73]

> "In the development of the plans for the College of Human Development we have indeed relied heavily on the College of Agriculture model and are continually trying to develop our research programs in close collaboration with various publicly supported human service agencies - and with considerable success I might add - so as to maximize the chances of useful results getting translated into public policy and program by way of continuing education and community service, among other means. The admin-

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[71] From Robert P. Hunter, Professor of Mathematics, October 31, 1974.

[72] From John M. Warren, see note 64 above.

[73] From Donald V. Josephson, see note 68 above.

istrative organization of this college is set up intentionally to make possible the easy cooperation of people from different academic backgrounds as they attend to complex social problems whether through teaching or research."[74]

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[74] From Theodore R. Vallance, Professor of Human Development and Associate Dean for Research, October 25, 1974.

G. EQUILIBRIUM OF ADMINISTRATIVE POWERS -

In Memorandum No. 11 above the author cites balance as the key term in the administrative arrangements for varied research aggregates within a single institution:

> ". . . it is necessary to assure a balance. Close departmental ties and close administrative control help assure that the centers and institutes do not go their own way, using the resources to build autonomous empires. Although greater autonomy might better enable the units to respond to society's needs for immediate answers, there is greater risk that they might move away from the primary missions of a University, which are student focused."

An overwhelming majority of the respondents concur with this statement, although with differences of intonation and emphasis. Except for the central point of conflict, professorial appointments, where differing shades of opinion move toward head-on opposition, continuing tension between innovation and "the establishment" is regarded as not only tolerable but necessary. No general interpretative remark is required at this point, for each of the quotations below is itself an essay in this genre. The quotations are presented alphabetically with reference to their authors' names:

> "I believe that the University should make an investment in the development of pilot projects which cross conventional boundaries. . . . On the other side of the coin, the psychological and economic comforts of 'stasis' should be preserved until we have abundant evidence that the new is superior to the old."[75]

> "Mechanisms for adapting to changing external conditions in an orderly fashion are equally important to biological species and to universities, in their abilities to compete and to survive. Biological aspects are discussed in articles such as those by J. Clausen and W. H. Heisey (1960. The balance between coherence and variation in evolution. Proc. Nat. Acad. Sci. 46: 494-506), and by G. E. Rehfeldt and D. T. Lester (1969. Specialization and flexibility in genetic systems of forest trees. Silvae Genetica 18(4): 118-123). The article by Straus contains observations that lead me to a somewhat different conclusion than the author's.

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[75] From Richard L. Frautschi, Professor of French and Head of Department, October 21, 1974.

I believe that the university should seek a balance between the forces of change and the stabilizing influences, rather than radical internal change ."[76]

"I suspect that the traditional disciplines have indeed opposed certain IDS programs. However, I would venture to say that the reason is a matter of confidence. Sternberg remarks that '. . .those who would participate across disciplines are generally regarded with some suspicion and often believed probably unable to have made it in his own field, and therefore not deserving of the rewards that his own department can bestow.' Here, Sternberg is right on target."[77]

"I am against the total interdisciplinary approach as proposed by the authors because it usually leads to 'fire fighting' research. I believe that good research and expertise is developed over a period of time and should not be subjected to fads because that is where the money is. Again our college has enough flexibility to allow 'fire fighting' if needed, but retains the departments to have a home for the researcher to return to."[78]

"We all should work hard to make sure that people are not hampered in their scholarly activities by departmental or college boundaries, but we should not view interdisciplinary research as an end in and by itself. The Engineering Acoustics Program and the Transportation and Safety Center are examples of worthwhile and valuable interdisciplinary arrangements which grew out of a genuine desire on the part of faculty members to work together, and we should make sure that this kind of thing continues to be possible. We should not, however, put time and effort into organizations which are not the outgrowth of grass roots efforts."[79]

"Both disciplinary and interdisciplinary organizations are essential on a campus today. They help each other and neither will remain healthy without the other. By and large disciplinary work is more important at the undergraduate level, and interdisciplinary at the graduate and research level."[80]

"Successful and meaningful interdisciplinary research in the university community will result from the productive interaction of faculty stimulated by shared interests and concerns, and a mutual recognition of contributions and needs which cross the boundaries of conventional disciplines. An administrative structure can encourage such cooperation, but cannot direct it."[81]

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[76] From Henry D. Gerhold, see note 59 above.

[77] From Robert P. Hunter, see note 71 above.

[78] From Felix L. Lukezic, see note 61 above.

[79] From Merrill E. Noble Professor of Psychology and Head of Department, October 14, 1974.

[80] From Rustum Roy, see note 27 above.

[81] From Robert F. Schmalz, Professor of Geology, October 22, 1974.

". . . we should not close off the possibilities of interdisciplinary and multi-experimenter research; however, at the same time, we should not somehow indicate that this is of greater virtue or worth more support or interest than the more traditional research effort led by a person committed and continuing to be identified with a specific discipline ."[82]

"The tensions between the interdisciplinary area and the traditional area -- even between the directors and/or program heads -- is likely to continue until resolved in each case by merger, detente, or the succumbing of one to the domination of the other. All three have already happened here. But this is as it should be. Continuity and change exist symbiotically at a good university."[83]

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[82]From Bruce M. Siegenthaler, Professor of Speech Pathology and Audiology and Director, Speech and Hearing Clinic, October 28, 1974.

[83]From Stanley Weintraub, Research Professor of English and Director, Institute for the Arts and Humanistic Studies, October 7, 1974.

H. RESEARCH AND INSTRUCTION -

In Memo No. 1 above the author criticizes the target articles as follows:

> "Unless I've missed something, the words 'teaching' and 'students' appear only once in these two essays, which is probably indicative of how much attention they would get in a University structured along the lines suggested by Straus and Sternberg."

Whenever research is under discussion among university faculty members, important assumptions concerning responsibility for the instruction of students are always active, whether or not they are expressed. The nature of the target articles in this instance is such that reference to instructional implications of research occur only incidentally. However, to ignore them would constitute a distortion of the correspondence. The general interpretative remarks below, and their illustrative quotations, represent only fractionally the full range of issues implicit in this topic.

Research and advanced study, however organized, depend upon discipline-oriented undergraduate training.

> "I have come to believe that disciplinary structure is preferable at the undergraduate level so that a student can obtain a strong background of fundamentals in a narrowly enough specified area of study to have developed some real competence. This is particularly important in Science. I believe that a person who intends to make any significant contribution to interdisciplinary science must do work at the graduate level following a strong undergraduate background in the fundamentals."[84]

Interdependency between research and instruction varies in pattern and implication from field to field and from one situation to another.

> "In my opinion a serious threat is to be found in the implied connection between student credit hours and departmental evaluation. It seems to me that departments which offer difficult curricula and which cannot offer positions with munificent salaries at the completion of studies are in. . .potential danger. In the Soviet Union even language and literature research institutes have separate funding and

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[84] From John M. Norman, Assistant Professor of Meterology, October 16, 1974. Cf. note 80 above and the quotation cited.

members of these institutes do not have to justify their existence by the presence of vast numbers of students. I prefer the U.S. system which ties research to teaching, but I believe that it should be recognized that even though we may have few students, we are performing a function of keeping scholarship in rather neglected areas alive."[85]

"The major obstacle to carrying out a research program here is the excessive teaching lead and the difficulty in persuading granting agencies to provide for very large amounts of released time."[86]

Research competes with instruction for time and resources.

". . . it seems to me that the people who are teachers most often go unrecognized, rather than researchers going unrecognized."[87]

Communication of research results to potential users poses special problems to institutes and centers without formal programs of resident or continuing instruction.

"Sternberg introduces and discusses an important aspect of University research, that of technology transfer to users. Within our Institute we have long felt that the need for much more effort in this direction is important. But we have met with little success in convincing the administration of this need, and have been provided virtually no support, financial or otherwise. As a result, much of our research sits on library shelves in want of someome to take it and 'translate' it into a form usable by the non-university community. We can't expect faculty researchers to write popular articles for non-scientific personnel, answer numerous letters of inquiry of a very general nature, or spend much time appearing before non-scientific audiences. Yet this is what technology transfer is all about.

"The agricultural extension model may not be suitable for American industry. There are several million farm families. There are only a few steel companies. For some kinds of businesses or industries, one "extension agent" perstate, rather than per county, may be a viable alternative."[88]

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[85]From William R. Schmalstieg, Professor of Slavic Languages and Department Head, October 4, 1974.

[86]From Bennett Dyke, see note 25 above.

[87]From Bruce M. Siegenthaler, see note 82 above.

[88]From Hays B. Gamble, see note 53 above.

SUMMARY AND CONCLUSION -

These materials have been presented as nearly as possible in their original form, the form in which they were expressed by faculty members actively engaged in research of the kinds which are under examination. In so far as the underlined "general remarks" by which they have been organized and interpreted represent them accurately, they may be summarized as follows:

With regard to the responsibility of universities to commit their facilities and faculties on the solution of immediate societal problems, it is important to remember that -

The scientist's value is dissipated if his services are required for problems which do not engage his particular expertise.

The university is capable of societal initiatives of its own.

Research in a university should have an instructional dimension.

Instruction in a university should have potential for research.

Consideration of university organization requires appropriate regard for all areas of university activity.

The academic disciplines constitute, each in its kind, a stage of human achievement; they should be subject to growth, and change, but not to abandonment.

With regard to the organizational forms required for the performance of interdisciplinary research functions, it is important to remember that -

Interdisciplinary research has been and continues to be a commonplace of university experience.

Departments and colleges pose no necessary threat to interdisciplinary collaboration.

Interdisciplinary organizations may imply managerial leverage.

Special value does not attach to interdisciplinarity per se, but to interdisciplinarity under certain conditions.

Interdisciplinary research is independent of administrative structures, or

interdisciplinary research requires appropriately structured administrative support.

Cross-disciplinary organizations may serve purposes other than research.

Interdisciplinary research may or may not be applied research; applied research may or may not be interdisciplinary.

With regard to the location of authority in universities, the centers of determinative influence, they are variously perceived as resting in individual scholars, departments, colleges, central administrative offices, and agencies external to the universities, as follows -

The scholar who declines collaboration will have his wishes respected in proportion to the degree of his success.

In a large university departments have the critical magnitude at which self interest and professional interest most nearly coincide.

Departmental structures are reflected in and reinforced by national professional associations.

Although colleges seldom have the homogeneity of departments, college deans often have great influence.

Through its control of budget making, disbursements, and accounting, central administration holds determinative authority in academic decisions.

Organizations committed to research are directly affected by funding policies of governmental agencies.

With regard to departmental organizations, their relationships to intellectual disciplines, and their functions with regard to research, opinions and emphases varied as follows -

Departments reduce institutional confusion.

All administrative agencies are vulnerable to distortion by aggressive parochialism, departments no more nor less so than others.

The academic disciplines are the indispensable foundation on which intellectual enquiry is based.

Administrative departments and their corresponding academic disciplines are not necessarily or permanently coextensive.

Some stable departments are defined in terms of mission and without explicit reference to academic disciplines.

Departments are designed to be both disciplinary and serviceable, although the two functions may be honored in varying proportions.

Review of departmental programs by intra-institutional officers or committees is intrusive and ill-advised, or

review of departmental programs by intra-institutional officers or committees is constructive and necessary.

With regard to the prerogative of initiating recommendations to appoint persons to positions of professorial rank in the university faculty, a prerogative characteristically vested exclusively in departments and colleges, only one interpretive remark need be made -

This is the hinge point on which administrative decisions with respect to the relationships between collegial and extra-collegial organizational structures are understood to turn.

With regard to citation of agricultural colleges founded under the Land-Grant Act as models for the development of further interdisciplinary research agencies, one interpretive remark is again sufficient -

Throughout the history of the Land-Grant Acts the interaction of Agricultural Colleges and Research Stations with their collegially organized host universities has on the whole been mutually advantageous and productive.

With regard to the location within the university of ultimate responsibility for decisions pertinent to research, faculty members recommend a complex balance of powers, or equilibrium, which may be summarized as above: Except for the central point of conflict, professorial appointments, where differing shades of opinion move toward head-on opposition, continuing tension between innovation and "the establishment" is regarded as not only tolerable but necessary.

With regard to instruction, and the appropriate relationships between instruction and research, it is important to remember that -

Research and advanced study, however organized, depend upon discipline-oriented undergraduate training.

Interdependency between research and instruction varies in pattern and implication from field to field and from one situation to another.

Research competes with instruction for time and resources.

Communication of research results to potential users poses special problems to institutes and centers without formal programs of resident or continuing instruction.

In keeping with the basic policy of this study, the privilege of the "last word" should rest with the respondents themselves. By coincidence two late arrivals in the exchange afford paragraphs which answer the purpose quite well:

> ". . . just at the time when our academic unit (The College of Human Development) was consummated many of the more established units and disciplines discovered the need for broadening their perspectives and addressing applied social problems. Ironically a new kind of 'turf' issue emerged when traditional departments and disciplines attempted to address some of the same applied social problems as we identified in our own (interdisciplinary) mission. A new kind of sorting out -- new kinds of boundary definitions -- in this regard has been in progress and the kind of tension which seemed to be developing earlier has now subsided."[89]

> "Perhaps the answer lies in directions already taken by the best universities in providing support and encouragement to interdisciplinary research through research institutes or centers organized around human problem areas, and in which scholars from various disciplines can bring to bear their individual and discipline skills in analyzing these problems. The researchers under such arrangements retain their discipline "homes" in their departments but the focus of their research may transcend their individual disciplines. It is a fruitless effort to attempt to make sociologists or psychologists out of economists, but there are ways in which they can work together fruitfully and learn from one another in a work situation. But mere administrative organization cannot suffice by itself to provide the useful interchange. Scholars from various disciplines must be drawn together by a common interest and on-going research in these problems. I am impressed with some of the results of such efforts in some of our own institutes and centers. If scholars are bound together by a working interest in common problems, the outcome may well be more and better than the sum of the efforts coming out of research along disciplinary lines. If such interdisciplinary research is fruitful, this may well create the basis for curricula and courses which cut across and transcend traditional discipline lines."[90]

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[89] From Raymond G. Studer, Professor of Environmental Design and Director, Division of Man-Environment Relations, November 13, 1974.

[90] From Grant N. Farr, Professor of Economics and Department Head, November 18, 197

APPENDIX to Chapter III

Robert Straus, "Departments and Disciplines: Stasis and Change," Science, 182 (1973), 895-98.

Sidney Sternberg, "The Management of University Interdisciplinary Research," University of Southern California Research Management Improvement Workshop, Los Angeles, July 9 and 10, 1974. Mimeoscript of a talk delivered at the Workshop.

Departments and Disciplines: Stasis and Change

Significant multidisciplinary activity requires a redistribution of power within universities.

Robert Straus

This article concerns the role of disciplines and departments vis-à-vis the forces of stasis and change that envelop American society and universities in the 1970's. I begin with some brief observations on the phenomenon of change and then move to considerations of society, universities, disciplines, and departments, in that order.

In the history of man, change in technology and knowledge and in their impact on the complexity of human organization has been a constant phenomenon and has, until the last century, accelerated only gradually. We like to think of our recent ancestors as people who experienced no more than one or more major changes within their lifetime, in wistful contrast to the constant and rapid changes we now experience. Today, as novelist James Michener has so aptly noted in *The Drifters*, even "nostalgia isn't what it used to be" (*1*).

With the perspective of history, we can cite periods of varying rates of change and variations in the degree to which the norms of social behavior have resisted or encouraged change. We are now at a point in this cycle when nearly a century of rapidly accelerating technological innovation and scientific discovery has been supported in many aspects of social living by a simplistic assumption that all "progress" was good and often by demands for the premature implementation of as yet untested technological innovations. Striking examples of premature implementation are found in medicine, warfare, and transportation. We have been suddenly overwhelmed by geometrically accelerating rates of change that affect every facet of living, and we are trying to apply the brakes.

Control over the use of new "miracle" medications is replacing unqualified demands that they be made available even before being thoroughly tested. We have temporarily, at least, called a halt to supersonic air travel and are resisting the construction of new airports and highways. We are pulling back on our explorations in space and have drastically reduced or eliminated public support for research in general.

At the moment, although resistance to change is a dominant public mood, the effect seems analogous to that of trying to stop a car on an ice-covered road when the accelerator is stuck. The forces and momentum of change are so great that resistance may make the course more erratic, but cannot stop or control the movement.

As societies' values and their attitudes toward change have varied, they have affected the relative status and rewards accorded individuals fulfilling different roles for the society and have been reflected in a wide variety of manners and morals. Warriors, clergymen, educators, physicians, farmers, industrial workers, scientists, businessmen, and bureaucrats have all experienced periods of varying respect and power. Social customs and codes regarding such areas of behavior as dress, hairstyle, sexual permissiveness, intellectualism, fads in literature, music, and other art forms, and the use of intoxicants have also varied according to whether the generally prevailing social norms were directed toward preserving stasis or producing change.

The author is professor and chairman, department of behavioral science, College of Medicine, University of Kentucky, Lexington 40506. This article is adapted from a position paper prepared for a symposium on the Future of the University: Stasis and Change, held by the University of Kentucky's Center for Developmental Change in February, 1973.

Universities and Society

Universities have experienced society's vacillating attitude toward change in two ways. As instruments of society, universities have been a major force in extending human knowledge and exploring its applications to human needs. Education and research are at the same time instruments and symbols of change and progress. The relative favor and disfavor that universities have been accorded in different periods and the level of societal support provided for intellectual activities in general are directly correlated with the moods of society regarding stasis or change.

Internally, universities have been microcosms of society at large, subject not only to external pressures, but, perhaps even more significantly, reflecting the prevailing and often conflicting attitudes and values of their own faculties and students. Universities face a major crisis as they strive, on the one hand, to protect those unique functions and features that have made their contributions to society so great and, on the other, to respond to changing demands and increasing pressures and responsibilities that society is placing on them while reducing their relative freedom, prestige, and support.

Only yesterday, the university saw itself as a community of scholars. The ideal professor was inner-directed, intellectually curious, insightful, independent in his pursuit of knowledge, imaginative, a model of integrity, and intensely involved in inquiry. He was both a paragon and the conscience of the society. As such, he was seen as requiring, and deserving total freedom. Kingman Brewster has urged that professors "in the development of their ideas . . . should not be looking over their shoulders either in hope of favor or in fear of disfavor from anyone other than the judgment of an informed and critical posterity" (*2*, p. 382). It is in order to protect academics from retribution by those who disagree with knowledge or are threatened by discovery that Brewster and many others see tenure as a necessity.

There is real reason to fear that contemporary society, as part of its effort to put the brakes on rapid change, will try to control academic activity and to stem the free flow of ideas, with which progress and change are so intimately associated. This threat to the freedom of universities now exists in the dominant, anti-intellectual element of the political sector of our society. How-

ever, despite the disturbing implications of policies currently emanating from Washington and from many state capitals, the most serious threat to academic freedom does not appear to lie in the direct control of universities and professors by outside forces. It lies instead in the impact of outside threats on the development of a wide range of self-imposed controls on academic freedom that are developing within universities themselves. These controls take many forms, but they almost always include regular, periodic "review and evaluation" of academic personnel by their superiors, their peers, and, not infrequently, their inferiors. In this connection, Brewster has noted that "assuring freedom from intellectual conformity coerced *within* the institution is even more of a concern than is the protection of freedom from external interference" (*2*, p. 382). Specifically, he stresses that situations which force professors into "jockeying for favor by trimming the argument because some colleague or some group will have the power of academic life or death in some later process of review would falsify and subvert the whole [intellectual] exercise" (*2*, p. 383).

I agree strongly with Brewster concerning the negative impact of too many internal controls in our universities today. Whether in establishing rules and procedures for faculty review or in imposing rituals and hurdles for students to suffer, universities seem today too preoccupied with protecting society from the few incompetent professors or from the poorly motivated, lazy, or intellectually inadequate students; rather, universities should emphasize the free flow of ideas among faculty and students who are gifted, excited, and inspired to function above the level of mundane rules and regulations that coerce conformity to mediocrity.

On the other hand, I disagree with those who believe that universities can continue to concern themselves primarily with the generation of ideas and the discovery of techniques without accepting some responsibility for the impact upon society of the forces for change which they generate. Nor do I believe that a community of scholars can remain insulated from changes in society or the impact of society's reaction to the stresses of unprecedented rates of change. I believe that universities, as we have known them, must change to meet the expectations and needs of a changing society. They need not, however, become mere factories for the production of technically trained people in whom inventiveness has been stifled. Rather, they will be supported only if they extend the concept and function of scholarly activity to include use of knowledge to serve man's needs and to meet the problems created by and stemming from change itself.

Departments and Disciplines

A major impediment to changing the nature of scholarly activity is found in the internal organization of universities and in the role played by departments as bases of power. As they have emerged and become entrenched in American universities, most departments have been oriented toward and identified in terms of specific disciplines.

In the academic sense, a discipline is generally defined as a branch of knowledge involving both research and teaching. As long as they are identified with the search for knowledge, disciplines cannot be static. They are forever changing, in terms of both the spheres of knowledge that they encompass and the conceptualization of the meaning of knowledge that they represent. Although the pursuit of knowledge and changes in perceptions within particular disciplines have moved at varying rates, usually dictated by the prevailing attitudes of the larger society, some change is inherent in the very nature of the search for knowledge. However, because the term "discipline" is used to refer to that which is taught, there are numerous examples of stasis, obsolescence, and anachronism. These reflect the ideology and behavior of some "disciplinarians" as teachers and the content, concepts, and methods that they select.

In great measure, the static nature of that which is taught is a result of the emphasis on knowing rather than searching. As long as much of what we call education relies on teaching fixed concepts of "facts" that students must memorize, and as long as students' proficiency is measured by their ability to discriminate between that which is termed "right" and that which is termed "wrong," disciplines will be perceived as static rather than dynamic. Where it has infiltrated our educational systems, such two-value orientation supports resistance to change. Yet the entire history of human knowledge and culture is replete with examples of the tentative nature of so-called facts. This is obvious in every sphere of scholarly pursuit and is, of course, basic to the "testing of assumptions" aspect of scientific philosophy and method. Whether one is speaking of research or teaching, change is related to asking questions and assuming the tentative nature of facts, while stasis is identified with the worship of absolutes and an emphasis on knowing rather than thinking or inquiring.

In the pursuit of knowledge, disciplines have been subject to constant change, in keeping with the logical groupings of theories and concepts that particular lines of inquiry have suggested. There is nothing intrinsically permanent about disciplines; they are merely convenient subdivisions of tentative knowledge, concepts, and methods that at particular times have appeared meaningful and functional. As man's knowledge changes, it is logical and necessary that the boundaries of disciplines should change accordingly. Indeed, this change is constant, and it is reflected today in the significant amount of multidisciplinary activity between and among scholars. Most such interchanges, however, take place outside of and in spite of the formal organization of universities. The formal organization exerts great force toward maintaining the status quo and is a major barrier to any change in the traditional and entrenched departmentalization of academic activity.

The organization of American universities into departments has developed almost entirely along the lines of the disciplines that departments represent. Historically, such administrative divisions were seen as implementing the development of the discipline and facilitating the major functions of research and teaching as represented by each discipline. Although such organization has been functional, the departmental structure that was created to facilitate development and change has become, ironically, a major force in restricting, impeding, and, in some instances, actively resisting change.

This has occurred, I believe, because departments have become the principal bases of power within universities. As political units, departments compete with each other for such sources of power as funds, space, curriculum prominence, and number of faculty positions; they are also concerned with distributing duties and responsibilities and with allocating space, equipment, personal assistance, salary increments, promotions, tenure, and other rewards among their faculty members.

Power and Resistance to Change

Like most political bodies, departments have felt obliged to assume clear-cut identities around which to rake their claims and to demand the allegiance of their members. Because almost all departments are identified with specific disciplines, their political functions have often served as forces to preserve anachronistic disciplinary identities, to enforce obsolete compartmentalization of teaching, and to discourage formal research and teaching activities that cross disciplinary lines. This adherence to fairly fixed departmental-disciplinary boundaries has been vigorously supported by many faculty who wish to work within comfortably delineated areas of specialization and subspecialization, unperturbed by the need to recognize broader implications in their own spheres of interest and blissfully oblivious to the implications that developments outside of their discipline may have to their own special interests. Societal pressures on universities to broaden their impact on social problems now make such a limited concept of academic freedom obsolete.

I believe we are on the verge of a major change in the organization and power structure of our universities, a change that will drastically alter the nature of departments and the role they play with respect to stasis and change. The breakdown of traditional lines between departments is actually being caused by both internal and external forces. So much specialization has developed within disciplines and so much subdivision of interests is constantly taking place that there are few really homogeneous departments. For example, literature departments now have their specialists in various periods, genres, and individual writers. History departments comprise scholars who specialize in different periods and regions. Anthropology departments include archeologists, physical anthropologists, linguists, area cultural specialists, and members who focus on specific contemporary problems. Often today, the various specialists and subspecialists within departments have relatively little knowledge of or interest in the work of their departmental colleagues. Instead, the special interests and expertise of many contemporary scholars impel them to cross both departmental and traditional disciplinary lines for the logical extension of their inquiry and interests. Thus, the specialist in west coast Irish literature of the 19th century may find common interests with an anthropologist who has studied the Irish culture of this period, or with an historian, a political scientist, an economist, a geographer, and a linguist who also have common area and period interests. The physical anthropologist may feel more at home with some anatomists than with cultural anthropologists. The neurophysiologist, neuroanatomist, and psychopharmacologist may find more common interests with each other than with some of their colleagues in their respective departments of physiology, anatomy, and pharmacology.

Multidisciplinary Activity

An increasing amount of cross-departmental activity is taking place in our universities. More of this involves informal than formal alliances. Yet even at the formal level there have been numerous efforts for at least 50 years to structure multidisciplinary research and teaching. These have ranged in scope from core courses taught by faculty from two or more departments and interdepartmental majors, to large research centers or institutes organized around a cluster of related disciplines or around specific human problems. The record of such efforts reflects a high rate of attrition and frequent failure to achieve aspirations. Yet an examination of the history of multidisciplinary programs suggests that their problems have stemmed not so much from the inherent difficulty of crossing disciplinary lines as from the political errors of ignoring the force of entrenched departmental power. Such programs often found that they could not attract the hoped-for allegiance and involvement of prominent scholars. This was in great part because, no matter how interested these men might have been, their professional advancement and personal rewards depended primarily on their works being viewed as contributing to the goals and images of their departments. In light of this continuing political pressure, it is remarkable that a few multidisciplinary programs have in fact attracted some outstanding scholars and have successfully fostered cross-disciplinary inquiry and activity.

It is significant that Yale University, whose productive Institute of Human Relations never quite achieved its promise and was phased out by a president who stripped the university of virtually all activities that did not fit the formal departmental structure, has recently established the Institution for Social and Policy Studies based on the conviction that "the cooperation of faculty and students from various disciplines and professions in problem-oriented multidisciplinary settings can advance understanding and develop better policies" and "that students educated in such settings will be better prepared for positions of responsibility whether in government, education, business, or community organizations" (*3*). Yale's institution, like its old institute, relies on participation by faculty whose primary base will be in academic departments. The success of all multidisciplinary and applied academic efforts, however, whether institutes, centers, programs, or simply courses, must in the long run depend either on their having sufficient strength to compete with the entrenched base of departmental power, or on the diminution of departmental power.

The volume of cross-disciplinary activity in our universities today is so great that change seems inevitable. This change may take the form of a realignment and redefinition of the traditional disciplinary boundaries. Unless departments permit such change, the only alternative, in order to overcome their effectiveness in resisting and blocking change, will be to redistribute the base of power within universities. As noted earlier, a trend in this direction is already apparent in the establishment of supradepartmental review processes for evaluation, promotion, and tenure.

Summary

Because I believe that the departmental power base of universities has been a major factor in resisting inevitable and continuing changes in the disciplinary boundaries of research and teaching, I predict that significant changes in the nature of departments are inevitable. Departments will either permit, or even seek, a realignment of their spheres of control over disciplinary activity or they will lose the power of control over basic academic decisions and rewards.

To the extent that society at large expresses resistance to change, the status quo of departments may have a temporary lease on life. On the other hand, society's current disenchantment with academia may make radical in-

ternal change seem vital to the maintenance of public support, and even the survival of universities, and thus hasten changes in either departmental structure or departmental power. Within universities, resistance to such change is generally supported on the assumption that academic freedom will be threatened. Obviously, all change involves some risk, but a very significant limitation to academic freedom already exists in the pressures that many departments exert on members to restrict their intellectual activity to fit the departmental mold. Departments can regain their important role in fostering both academic freedom and academic responsibility for excellence if they will redefine their discipline-oriented identities and realign their priorities to include cross-disciplinary inquiry and teaching and greater responsiveness to the responsibilities and expectations of the university and society.

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The Management of University Interdisciplinary Research

Sidney Sternberg

The National Science Foundation in fiscal year 1973 initiated a program of investigation on the improvement of research management at universities. The program was supported with a budget of $1 million and again in fiscal year 1975 the President is requesting Congress to appropriate $3 million. Although covering many different facets of research management problems, the one which is perhaps the most timely and critical is that of interdisciplinary research, which is the responsibility of this USC/NSF grant and the workshop in which you gentlemen are interested enough to participate.

Historically, the NSF has been active in supporting by budget plan programs of interdisciplinary research. In fiscal year 1969, a program was organized called IRRPOS (Interdisciplinary Research Relevant to Problems of our Society). Later in 1971, this evolved into the Research Applications Directorate and the RANN program (Research Applied to National Needs). Over the relatively short period of time, the budget for supporting this program has grown to well over $100 million with the largest percentage of this budget supporting on the University campus interdisciplinary research applied to national needs.

The NSF has established a policy to support a spectrum of research activities. This research spectrum provides for the exploration of new knowledge and the focusing of knowledge toward application which enhance the opportunities for its utilization by society. The NSF fiscal year 1975 budget clearly recognizes this need and commits itself to this end in the development of programs and expenditures of funds. Let me quote a couple of paragraphs from the Presidents Fiscal Year 1975 budget to Congress.

"The Foundation's program of Research Applied to National Needs (RANN) is designed to focus U.S. scientific and technical resources on selected problems of national importance with the objective of contributing to their practical solution" (PB-G1)

Again (PB B-3) "While the Scientific Research Project Support (SRPS) activity supports research usually related to many objectives, a more selective approach will be used in fiscal year 1975 to orient some of the research to those inquiries evaluated as most likely to have a potential impact or promise on energy resource discovery, production, conservation and use."

At the NSF level, organizational entities have been established to help realize these objectives such as the ERG office in AD/R, the RA Directorate, the R&D Incentives Program, and Research Management Improvement Program in AD/NI. These efforts represent well over $200 million of fiscal year 1975 funding. Whereas these steps are essential to realization of the research spectrum, it is imperative for success that the university campus commit itself to support these policies and organize to do so by providing a healthy and rewarding climate for interdisciplinary research.

In order to move positively toward these objectives, there are specific key issues which need to be addressed. Let me first list the issues as I see them, and then examine each in greater detail.

First - There must exist a real external demand and need for IDR (Interdisciplinary Research) and internally on campus a real recognition that interdisciplinary research is an equal goal and objective in the university along with education and individual discipline research.

Second - Incentives and rewards must be provided to both the University Administrators and its trustees, and the faculty for pursuing and successfully realizing this objective.

Third - IDR (Interdisciplinary Research) is not self-serving and cannot end on campus, but must include the transition and interface with industry and the public administration in order to be viable.

Fourth - It must be recognized that the general problem of an organization engaging in multiple goals and objectives which are sufficiently different while still utilizing common facilities and resources, is not completely new. We should use where applicable, models and precedences available in industry, government, and on campus to provide useful guidance. Particular attention should be given to the land grant agricultural university system.

And lastly, fifth, which is in large measure why we are here today, to find the methodologies best suited for carrying out interdisciplinary research which will support recognized stated goals for the university campus. And now let us examine each of these five points in greater detail.

I. As I have previously stated, to the extent that NSF represents external demand for interdisciplinary research, there is a real requirement by the federal government. Other agencies also have applied research budgets. Foremost, of course, is HEW, and with considerably smaller budgets found in EPA, DOT, HUD, Commerce as well as others. One can of course question the existence of real problems, the solutions to which lend themselves to application of scholarly research. I would contend that the need for energy, the conservation and improvement of our environment, and the need to increase this country's productivity so that we can maintain our high standard of living are categories of real social need which, in fact, can be served by interdisciplinary research. I would further contend that the existing format of our research, development, production, and marketing institutions will not be able to satisfactorily serve the needs of the nation on a timely basis. The conclusion reached therefore, is that the need is real, and the money is available to support interdisciplinary research and that this situation will exist for many years to come. However, except for individual faculty and adminstrators of universities, I have not found that the university has commited itself to these ends, and has not clearly stated interdisciplinary research as a goal and objective with the necessary support to assure its success and viability. Until the decision is made, further progress in improving the management of interdisciplinary research will be extremely limited.

II. It does not require a great deal of astuteness to understand that without visible recognition that only the purest and most dedicated of the members of the research profession will join in serving the needs of interdisciplinary research. The present structure of the campus into departments of traditional disciplines, whereas it may serve well the goals of education and research in each individual discipline, it does not serve to encourage and in many instances actually discourages the participants by faculty in interdisciplinary research. Titles and salary

increases are awarded to a large degree to those who follow the path of individual research, and the measurement for the most part is papers accepted by peer recognized journals. Those who would participate across disciplines are generally regarded with some suspicion, and often believed probably unable to have made it in his own field, and therefore not deserving of the rewards that his own discipline department can bestow. Ad hoc team arrangements are not satisfactory because they do not carry with them the incentives or recognition of the institution. There may even be a feeling that to serve in ad hoc interdisciplinary team arrangements too long and too well may be personally self-defeating.

I think it can be fairly said that the present system of incentives on campus does not truly satisfy the individual needs of the interdisciplinary researcher and as a result cannot yield in aggregate the most effective interdisciplinary research results.

III. Now for perhaps the most difficult aspect of interdisciplinary research. I have assumed in all my discussion that in most instances interdisciplinary research has as its raisne d'etre the solution to societal problems. The integration of knowledge from the broad spectrum of disciplines encompassing both physical and social science is required when a broad and complex societal question needs research for its answer. An answer is only valid and real when it is utilized by society in its attempts to solve its problems. Products and services are provided to the public through industry or the public adminstration and public policy through its elected officials. Only if the users, industry, public administrators or elected officials, successfully apply the results of research can the interdisciplinary research team be judged successful. It is, therefore, incumbent on those who manage interdisciplinary research to include in their planning the transitioning of their research results to the user. The team now has grown in that it not only includes researchers from a broad spectrum of disciplines, but also the users of research. How does one organize and manage interinstitutional interdisciplinary research? How can rewards be administered for faculty who not only visit and work with other disciplines on campus, but also may leave the campus to support the transitioning and utilization of the research

by user institutions. Unless these questions are part of the consideration in management planning and treated in this workshop, the design of any campus system will not have long term effectiveness or viability.

IV. The organization and operations of the agricultural research and technology system is perhaps one of the best to examine for our purpose here today. The land grant bill requires that the state university provide education and research in support of agriculture. Schools and laboratories were established. Perhaps, the most distinguished are here in our state of California, certainly fitting for one of the largest agricultural states in the country. The Department of Agriculture also established Regional Extension laboratories to work with the schools and help integrate the research. The Department of Agriculture also established a county agent system which was responsible for bringing to the farmers the knowledge that he desperately needed to maintain a healthy crop. These efforts over the past several decades have contributed to an agriculture industry which is the most advanced in the world. One of our single largest exports is food, contributing strongly to the plus side of our balance of trade. Let me tell you a story where the researchers contributed mightily in this successful enterprise. (See Gardener in the West by George S. Wells, published by Dodd, Mead & Co.) An airplane in 1953 traveling from the Mediterranean area to Albuquerque, New Mexico brought along as a passenger inadvertently on the part of the passenger as well as the transporter a lone yellow female insect. This insect found its way into an irrigated alfalfa field not far away. The result of this intrusion a year later was a severe aphid invasion in the alfalfa fields of Imperial Valley in California. Thousands of acres were being infected and spreading with the speed of a forest fire. Indeed, the alfalfa industry, one of the state's key crops, was being threatened with extinction. The University of California spearheaded by Riverside brought into being integrated control which called for a concerted effort by all the varied disciplines related to agricultural science to strike at an enemy from every angle. A broad spectrum of specialists, among them taxonomists, taxicologists, residue chemists, biological scientists, ecologists, economists, and economic entomologists were brought into the fray. After 85% of the fields in California had been affected and after a loss of some $40 million, the alfalfa aphid was brought under control by a conbination of chemical treatment by an organic phosphate - dematon - and biological control using wasps. This amazing story brought

into acceptance the then new concept of integrated control. This may not be too far removed for the label given our present efforts, that of interdisciplinary research. And now to management methodology!

V. Assuming that the decision has been made to include interdiscplinary research as an equal partner on campus, how best to implement the management? What are the resources required? First I would submitt that ad hoc teams pulled together from available personnel from discipline departments will not in the long term be adequate. They may serve the purpose to answer some specific research question, and will involve faculty and provide some experience on the nature of interdisciplinary research, but it will soon be recognized as ad hoc and will, therefore, over any length of time lose its faculty support. I do not propose to present a neatly packaged solution during the introductory panel discussion. I am not that brave or do I feel qualified to guess at the results of the strong and penetrating dialogue which will take place here today and tomorrow. However, I would like to draw your attention once again to an existing institution which I believe has been successful in its IDR program over many years, namely the arrangements amongst the Federal Department of Agriculture, the state land grant universities, and the user of the results of research; the farmer. There are many circumstances that are different in considering societal needs in energy the environment, and productivity. However, single-mindedness of purpose, science and its application to a specific industry, may prove to be a general concept that could be useful to help guide the course that needs to be taken today in our IDR as applied to national societal needs. If science and its application to a specific industry is an important concept and the establishment of departments or schools such as the school of agriculture is a necessary organizational plan, then let us consider the potential of establishing professional schools on campus within the context of today's industries, such as the schools of petroleum, plastics, coal, iron and steel schools of estuary waterways and rivers, atmospheres and pollution, textiles and industrial productivity, and at the same time establish the integrated relationship with the industrial users as was done in agriculture with the farmerwhich was an extensive network of so called county agents who spread the word and aggregated the needs of the industry. I would at least submit these thoughts to the workshops, and ask that they be considered along with all other potentially viable alternatives.

IV

CONCLUSIONS OF THE STUDY

A thrust toward management, administration, evaluation, judgment, selectivity has occurred during recent years in the educational and research establishment of the United States. After thirty years of acceleration, research is suspected of at some points running out of control. For this reason surveys, reviews, studies, and reappraisals have been commissioned at every level of research activity from that of the national foundations down to the individual laboratory and department. This critical stock-taking has been accompanied by a tightening of resources in education and in the society as a whole, with the result that what might have been a routine intellectual redding-up has taken on the pressure of necessity.

What the surveys are finding, or will find, becomes clearer from day to day, and it is now apparent that there is reason for concern. This judgment is confirmed by the readiness with which scientists and scholars have accepted the suggestion that they interrupt their primary activities for the time required to set their houses in order. Some of their discontents may be caused by difficulties encountered outside the university - strident advice, for example, to stop doing what they know they ought to do and do something else more important - , but it is unlikely that these causes would lead them to address the internal problems of their own universities. To account for the focus of their concern one must infer that they detect within the universities situations inimical to their professional interests.

From the nature of their response it appears that they see the basic problem in vulnerability to dilution of academic quality. Ordinarily impatient with any tendency toward centralization of

critical authority, they participate in officially organized and systematic examinations of academic programs. It is not the exercise of critical judgment that is new, but the overt and formal way in which critical judgment is exercised. Methodical evaluation is a natural defense against radical disunification, against the situation in which all values are pertinent and therefore none is effective.

The most widely adopted mode of operation for critical appraisal has been that of review of programs as opposed to projects. One of the successes of national research administration has been the development of procedures by which competent professional judgment of research proposals can be achieved with reasonable consistency and promptness. So pervasive is the influence of this system that "proposal" and "project" have become the unitary terms in research. "Research" itself may in common usage be defined as activity amenable to description in a proposal and to organization as a project. However, close examination of university practices indicates that although "proposal" and "project" are in lively currency, they do not denote the most fundamental and natural focus for critical judgment within the university.

Terminologies have not become firmly established in this area of academic usage, but "program" is being used in the sense of a more or less integral set of activities in which research and instruction interact to produce both new knowledge and persons in whose minds and skills the new knowledge is viable. "Productivity" and "impact" take on a somewhat altered significance in this context, not necessarily better than their implications for peer-group review as it is practiced in the national agencies, but different. The modes of judgment for which it is adapted are those by which active centers of competency or excellence, and their opposites, can be identified. One of the things that a program

produces is itself.

In this context the observations which have been made of academic attitudes and operations in the conduct of research suggest a number of general conclusions:

1. Organized peer group review, conducted by fully informed professionals in the appropriate fields, is the only effective means for evaluating a particular research procedure.

2. The natural authority for organized peer group review resides in the funding agency and for this reason is not a characteristic or dominant academic function.

3. Organized peer group review is most practicable in the proposal stage of a research procedure and diminishes in effectiveness as the procedure moves toward and into publication or application.

4. Research which is conducted in conjunction with instruction and academic public service loses sharpness of definition as project and takes on significance as an element in a more inclusive set.

5. The unitary basis for administration of academic research, here referred to as the program, assumes a magnitude from that of a committee to that of a college and seeks the qualities of organizational integrity and continuity.

6. Within academic administrative units research is considered in terms of total group performance and the crucial judgments are those which determine the membership of the group and its hierarchic structure.

7. A primary discipline affecting such administrative units is that of open and public conduct, with the overall record in research as a salient item in the account.

8. A second discipline derives from the constant shift and change among the responsible administrative divisions of the university, including the emergence of new complementary or competing agencies, which force evaluative comparisons and organizational adjustments at all levels both of research and of instruction. It is in this dimension that the powers implicit in central administrative control of institutional resources are most effective.

The research oriented university is a relatively new phenomenon in American society. It is a product of the concept of "big science," which is in turn a product of the experience of World War II. Its qualities, capacities, and limitations are not perfectly understood either on or off the campus. The

profound difference between these universities and the teaching colleges generally escapes the comprehension even of their friends. At the same time, they themselves remain teaching colleges, and the constant study of new knowledge as it impinges upon the knowledges which are to be taught as essential and fundamental is the ultimate and basic discipline.

APPENDICES

A. Internal Research Policies, a Survey of 42 Institutions.

B. Interview Summaries, University of Michigan.

C. Interview Summaries, University of Wisconsin.

D. A Comparison of Research Administration at Wisconsin and Michigan.

APPENDIX A

Internal Research Policies, a Survey of 46 Institutions

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PREFACE AND INTRODUCTION

The task of the Penn State study group is the identification of the criteria, procedures, and qualified personnel required for the evaluation of research in the natural sciences, technology, social sciences, and the arts and humanities. The decline in funding support that prompted our study is not unique to our institution. Other universities must grapple with the same kinds of problems. Conducting an inquiry into the "workings" of other leading universities on these issues seemed to be one fruitful approach to the task. This summary digest of research policies followed at selected American universities, then, is the result of that survey. Some general comments about the sample, our goals and methods, and the results may be helpful to our readers. The list of institutions picked, copies of correspondence, and a table of responses are appended to the manuscript.

In early November, 1973, we mailed a letter and postcard requesting information about internal research policies to 48 major research universities. We chose to sample those institutions, in addition to Penn State, that conferred the greatest number of PhDs in the sciences and engineering. Such a list appears on page 68 of *Science Indicators 1972*, a report of the National Science Board, 1973. Represented are private and public universities including land-grant and other state-supported institutions. Several instances occur in which more than one institution in a state is included on the list. Despite differences in organization or charter, several elements common to the group--substantial research budgets, reputations for academic excellence, and commitment to the educational process--made their potential experiences and insights invaluable to us in the formulation of policy at Penn State.

Depending on the university's organizational pattern, we addressed our correspondence to the Vice President for Research, the Director of the Office of Sponsored Research, or a high-ranking university official who would be familiar with the kinds of materials we sought. Although the letter stated that our mission was the generation of criteria and

guidelines for the distribution of intramural research funds, we also indicated that in the absence of such written information, we would welcome policy statements dealing with sponsored or external funds. Our correspondents were most generous in responding with mimeographed material and bound booklets or manuals that spoke to these issues as they perceived them from our letter. Also, the university officials originally approached assumed the responsibility of rerouting our letter in instances where a more suitable respondent was available to answer the questions we raised.

Our initial letter, followed by a reminder in January, 1974, prompted 46 replies out of a sample of 48, or a response rate of 96 percent. Thirty-one officials, 65 percent, forwarded informational items to us. Ten spokesmen indicated that their institutions were in the process of establishing or revising existing guidelines, and five delegates stated that their universities operated without any formal, written policies related to research. Less than half of the universities, in separate documents or as part of their research manuals, provided information about the kinds and sources of internal research monies, the spending restrictions placed upon them, criteria for eligibility, or the routing of proposals for such funds. Not all the institutions elaborated on these issues to the same degree, and none of them devoted any discussion to the substance of the proposals. The bulk of the materials received from those universities and others are related to external research support.

As a result of their generosity, Penn State is the recipient of an extensive and useful collection of reference documents related to all facets of research, not all of which we deem pertinent to this report. For example, discussion about patents and patent arrangements occurs

only when germane to the text. If Penn State, however, ever contemplates revising its patent policy, the collective wisdom of several other major universities is now on record. Similarly, we have amassed a library on such diverse topics as personnel classification systems, the care and feeding of laboratory animals and the permissibility of classified research, but again these will receive only brief mention.

This report is a partial synopsis of the current policies and practices prevailing at major research-oriented universities in the acceptance and conduct of research. The slant in the written policy statements is toward the generation of outside monies, since a primary objective of the academic committees and administrators who drafted them is extramural funding support for meritorious projects. Maintaining an atmosphere hospitable to research without compromising the integrity of its constituents is a major goal of the university. All portions in the manuals are not equally useful for our mission at Penn State, but many of the policies pertaining to research authorized by external sponsors are also applicable to research funding from within. Certain recurrent themes appear in all the policy statements. Some ideas are unique to one institution. The manuscript will include any suggestions we deem of value to our task.

Our report consists of two parts. The first section deals with the procurement and conduct of sponsored research including the responsibilities, duties and regulations incumbent upon the university, sponsors and faculty, information about drafting a research proposal, and the roles various university personnel play in the formative and final stages. The second portion, unsponsored research, is less lengthy, but more directly related to our task. Who, what, how and some why questions are answered, but, with one exception, not the criteria for selection. Our task remains.

UNIVERSITY RESEARCH DIGEST

I. Sponsored Research

University Policy

Almost all university handbooks begin with a general policy statement about the goals of the institution in seeking outside support for research: the education of students at all levels, advancement of knowledge through research and scholarship, preservation and dissemination of knowledge, and protection of the public welfare. One of the best statements about purposes and style of research applicable to a land-grant institution is the preamble in the research policy booklet drafted at North Carolina State at Raleigh:

> The University is dedicated to the pursuit of knowledge, its preservation and propagation, to the search for truth and a fuller understanding of mankind and the universe in which he lives and to the education and intellectual development of its students and constituents to the end that they may be better informed, better adjusted, and more useful members of the society. The development, protection, encouragement, and fostering of the spirit and of the habits of inquiry among faculty and students lies at the heart of the University's purpose and vitality. The development and maintenance of a program which provides intellectual stimulation and purposeful goals, and assures continuing relevance to the problems and concerns of the day necessitates a continual probing into new areas of understanding and a persistent attempt to push back the frontiers of knowledge in all fields. Research, scholarly work, and other forms of creative endeavor are essential for the continued intellectual growth of the University faculty and for the sustaining of stimulating and challenging teaching programs.
>
> The University has developed and cherishes its tradition of freedom of inquiry, freedom to probe objectively any fields of interest and relevance challenging the intellects of its staff members and of kindling, nurturing, encouraging, and developing such traditions among the students. Only through such traditions and practices can each succeeding generation hope to add wider visions and understandings of the world in which we live.

> As a Land Grant Institution, this University is charged with a further responsibility of concern for the well-being and economic and cultural inprovement of the citizens throughout the State. This concern necessitates intensive attention to the application and utilization of knowledge for the benefit of mankind, the development of new and improved technological applications, and the utilization of these applications in agriculture, industry, business, and in other areas of need in our community, state, and nation.[1]

In addition to the goal statements, most manuals list the criteria for acceptance of research so as to preserve institutional, scholarly, and individual freedom and integrity. The private universities are especially sensitive to the maintenance of their institutional perogatives, although the public institutions make clear what kinds of research they deem appropriate to their missions. Some of the most frequently mentioned or implied guidelines for safeguarding the institutional role in research are summarized below:

(1) funds should not be sought or accepted simply because they are available;

(2) the research should be of such a nature that the university would undertake the project if its own funds were adequate;

(3) the work must be of a research rather than developmental nature; the university cannot engage in projects which involve continuing large-scale production or manufacture; routine tasks will not be undertaken except where it is shown conclusively to the appropriate university officials that satisfactory facilities for such services do not exist elsewhere;

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[1]Ralph W. Cummings, Ch., *Research Policy* (Raleigh, N.C., North Carolina State University, 1972), pp. 1-2.

(4) the university exercises administrative control and responsibility for the work, and the research undertaken must conform to the administrative and fiscal policies of the university;

(5) projects should be clearly related to the academic programs of the departments involved and provide opportunities for graduate or undergraduate research training;

(6) the research should not distort the balance in the university's basic program or become a factor that results in disproportionate growth and development;

(7) the proposal must be in harmony with and contribute to improvement in staff capability, equipment, facilities and/or knowledge in some field considered appropriate to the university's central purposes and objectives;

(8) any results obtained and any papers published or lectures given by investigators on research projects are the sole responsibility of the investigator concerned. The university provides no institutional endorsement of the work or of the sponsor;

(9) the acceptance of the contract or grant implies a legal obligation to comply with the terms of the contract or grant;

(10) the research should not be at the expense of either undergraduate or graduate instruction.[2]

In case of national emergency, some of the universities might, with the consent of specially constituted academic committees, waive their prohibition about classified research. Barring such an eventuality, however, most of the universities decline to accept such research grants or contracts on the following grounds:

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[2]The University of Texas guidelines encourage sponsored projects in the areas of human rights and welfare, but disavows the role of advocate or social acti agency. (The citation for this policy guideline is missing. The corresponde forwarded just a few mimeographed pages to us.)

(1) the university will not administer funds whose purposes and the character of whose sponsorship cannot be publicly disclosed;

(2) the university will not accept research which carries security classification, requires security clearance of university personnel, or otherwise precludes general publication of results;

(3) the investigators have the full right to publish any results obtained by them, subject only to established safeguards for the protection of privacy or confidentiality of personal data.

The acceptance of classified research is seen as an abridgement of one of the primary objectives of the university: the dissemination of knowledge. Also, undertaking such research may not be in the best interests of the individual scholar. Promotion and tenure committees may not consider participation in such projects since neither the merits of the research nor researcher could be openly evaluated.

Universities affirm the rights of individual scholars to select the subject matter of their research, seek support from any available source and arrive at their own findings and conclusions. This freedom is not unlimited, however, and should not interfere with the rights of other scholars or commitments made by the university. For these reasons, many universities require researchers, who are contemplating projects, to answer a series of questions about personnel, space, and equipment allocations. These regulations are designed to protect the university community from unwise or unchecked expansion. They are:

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[3] Stanford University, perhaps because of the controversy surrounding William Shockley, states that space, facilities, funds and other resources will be allocated on the basis of the scholarly and educational merits of the proposed research, and not on speculations concerning the political or moral impropriety of the uses which might be made of its results. "Statement on Principles Concerning Research," mimeographed (Palo Alto, California: Stanford University, December 8, 1971) p. 1.

(1) Is the proposed program appropriate for the university and compatible with the department's goals and capabilities?

(2) Does it involve a commitment requiring additional staff or post-doctoral research associates; if so, what numbers?

(3) Does it require space beyond that now used, by the particular research group; if so, how much and is this space available?

(4) Does it require any special facilities or procedures such as special library materials or extensive computer time; if so, is provision made for them

(5) Will additional technicians, shop and administrative personnel be required as a result of this proposal; if so, how will they be provided?

(6) Is the budget adequate? Does the budget statement identify direct and indirect costs? Does the budget allow for contingencies and possible salary increases?

(7) Does the contract or grant require matching funds from the university?

Universities attempt to shield academics from internal or external interference, scholars from the excesses of other scholars, and themselves and sponsors from unethical faculty members. Some of the manuals indicate adoption and expansion of the 1964 joint policy statement of the American Council of Education and the Council of the American Association of University Professors on "Preventing Conflict-of-Interest in Government Sponsored Research at Universities."

The subjects of research, human and animal, are protected by a series of regulations pertaining to their health, safety, privacy and other personal rights. Some of these safeguards are carried out in conformity with federal directives; others are expansionsof minimum standards with regard to privacy, radiation hazards, and the infliction of pain or suffering by animals. Internal review committees have been

established at the universities that subscribe to these tenets, and proposals which make use of such subjects must have approval before proceeding with the research.

Despite some control over the techniques and methods of research, the academic researcher functions as a free agent in the choice of subject matter and the inferences and conclusions he may draw from his work. Universities hope that their faculties will undertake projects that offer promise of making significant contributions to the fund of knowledge, but they do not prescribe the kinds, tools or procedures of research. The manuals offer helpful hints about the types of research that will be looked upon favorably by certain federal agencies, but the individual scholar (unless it is understood to be part of his appointment) determines whether he will pursue mission-oriented or basic science research. Some of the research policy statements remind the academic community and others that the tools of research are unique to the researcher. For some, it is a well-equipped laboratory; for other, canvases, oils, and brushes. Similarly, size and scope of the research project is defined by the investigator, not the institution. It may be only one person; it could involve hundreds. Scientific projects, creative endeavors, training and educational programs, and faculty career development all enable the university to serve the world of ideas and society.

The Principal Investigator

Primary responsibility for the initiation and management of a proposal lies with the principal investigator. He must be a regular faculty or academic staff member who, in turn, is responsible to a chairman, dean or

director who indicates that the applicant possesses the judgment and technical competence necessary for the direction of the proposed research. There are prescribed administrative and departmental channels through which a proposal in the preliminary and final stages must pass before approval is given, regardless of the funding source.

Drafting the Proposal

Writing a research proposal, like writing any other request, is a problem of persuasion. It is well to assume that your reader is a busy, impatient, skeptical person who has no reason to give your proposal special consideration and who is faced with many more requests than he can grant, or even read thoroughly. Such a reader wants to find out quickly and easily the answers to these questions:

> What do you want to do, how much will it cost, and how much time will it take?
>
> How does the proposed project relate to the sponsor's interests?
>
> What difference will the project make to: your university, your students, your discipline, the state, the nation, the world, or whatever the appropriate categories are?
>
> What has already been done in the area of your project?
>
> How do you plan to do it?
>
> How will the results be evaluated?
>
> Why should you, rather than someone else, do this research?

These questions will be answered in different ways and receive different emphases depending on the nature of the proposed research and on the agency to which the proposal is being submitted. Most agencies provide detailed instructions or guidelines concerning the preparation of proposals.

Typical parts of a proposal are:

Title Page

Abstract

Table of Contents

Introduction (including Statement of Problem, Purpose of Research, and Significance of Research)

Background (including Literature Survey)

Description of Proposed Research (including Method of Approach)

Description of Relevant Institutional Resources

List of References

Personnel

Budget

The Title Page. Most sponsoring agencies specify the format for the title page, and some require that the principal investigator, his department head, and an official representing the university sign the title page. In addition, a title page usually includes the university's reference number for the proposal, the name of the agency to which the proposal is being submitted, the title of the proposal, the proposed starting date and budget period, the total funds requested, the name and address of the university unit submitting the proposal, and the date submitted. Some agencies want the title page to specify whether the proposal is for a new or continuing project, and some ask that any other agencies to which the proposal is being submitted be listed.

The Abstract. Every proposal, even very brief ones, should have an abstract. Agencies often use the abstract alone in their compilations of research projects funded or in disseminating information about successful projects. Though it appears first, the abstract should be written last, as a concise summary (approximately 200 words) of the proposal. The

abstract speaks for the proposal when it is separated from it, provides the reader with his first impression of the request, and by acting as a summary, frequently provides him also with his last. Thus, it is the most important single element in the proposal.

The Table of Contents. Very brief proposals with few sections ordinarily do not need a table of contents; the guiding consideration in this is the reader's convenience. Long and detailed proposals may require, in addition to a table of contents, a list of illustrations (or figures) and a list of tables. If all of these are included, they should follow the order mentioned, and each should be numbered with lower-case Roman numerals. If they are brief, more than one can be put on a single page.

The table of contents should list all major parts and divisions (including the abstract, even though it precedes the table of contents). Subdivisions usually need not be listed. Again, the convenience of the reader should be the guiding consideration.

The Introduction. The introduction of a proposal should nearly always begin with a capsule statement of what is being proposed. Some authors believe that the hard facts of time and money should be buried under a cushion of soft sell. They are afraid that the reviewer will stop reading at the sight of a dollar sign. Actually, the reviewer is much more likely to stop reading if he cannot quickly find out what he is to consider.

The main objective of the introduction obviously is to introduce the subject to a stranger. Administrators in sponsoring agencies want to get a general idea of the proposed work before passing the proposal to reviewers who can judge its technical merit. Thus, the introduction should be clear to an informed layman. It should give enough background to enable him to

place your particular research problem in a context of common knowledge and should show how its solution will advance the field or be important for some other work.

The Background Section. This section may not be necessary if the proposal is relatively simple and if the introduction can present the relevant background in a few sentences. If previous or related work must be discussed in some detail, however, or if the literature of the subject must be reviewed, a background or literature-review section is desirable.

Sufficient details should be given in this discussion (1) to make clear what the research problem is and exactly what has been accomplished; (2) to give evidence of your own competence in the field; and (3) to show why the previous work needs to be continued. Some sponsors want to know also who has funded the previous work.

Discussions of work done by others should lead the reader to a clear impression of how you will be building upon what has already been done, and how your work differs from theirs. It is important to establish what is original in your approach, what circumstances have changed since related work was done, or what is unique about the time and place of the proposed research.

Literature reviews should be selective and critical. Reviewers do not want to read through a voluminous working bibliography; they want to know the especially pertinent works and your evaluation of them. A simple list of works with no clear evidence that you have studied them and have opinions about them contributes almost nothing to the proposal.

The Description of Proposed Research. The comprehensive explanation of the proposed research is addressed not to laymen but to other specialists in your field. This section, which may need several subsections, is of course

the heart of the proposal and is the primary concern of the technical reviewers. Research design is a large subject here, and a few reminders concerning frequently mishandled aspects of proposals may be helpful.

1. Be realistic in designing the program of work. Overly optimistic notions of what the project can accomplish in one, two, or three years or of its effects on the world will only detract from the proposal's chances of being approved. Probably the comment most frequently made by reviewers is that the research plans should be scaled down to a more specific and more manageable project that will permit the approach to be evaluated and that, if successful, will form a sound basis for further work. In other words, your proposal should distinguish clearly between long-range research goals and the short-range goals for which funding is being sought. If your first year must be spent developing an analytical method or laying groundwork, spell that out as Phase 1. Then at the end of the year you will be able to report that you have accomplished something and are ready to undertake Phase 2.

2. Be explicit about any assumptions or hypotheses the research method rests upon.

3. Be clear about the focus of the research. In defining the limits of the project, especially in exploratory or experimental work, it is helpful to pose the specific question or questions the project is intended to answer.

4. Be as detailed as possible about the schedule of the proposed work. When will the first step be completed? When can subsequent steps be started? What must be done before what else, and what can be done at the same time? Sponsors appreciate the evidence that the investigator knows how to proceed in a step-by-step fashion.

5. Be specific about the means of evaluating the data or the conclusions. Try to imagine the questions or objections of a hostile critic and show that the research plan anticipates them.

6. Be certain that the connection between the research objectives and the research method is evident. If a reviewer fails to see this connection, he will probably not give your proposal any further consideration. It is better here to risk stating the obvious than to risk the charge that you have not thought carefully enough about what your particular methods or approach can be expected to demonstrate.

The Description of Relevant Institutional Resources. The nature of this section depends on your project, of course, but in general this section details the resources available to the proposed project and, if possible, shows why the sponsor should wish to choose this university and this investigator for this particular research. Some relevant points may be the institution's demonstrated competence in the pertinent research area, its abundance of experts in related areas that may indirectly benefit the project, its supportive services that will directly benefit the project, and its unique or unusual research facilities or instruments available to the project.

The List of References. This list is desirable only if the proposal contains six or more references. Otherwise, the references can be inserted in the text within parentheses, like this (A. N. Author, "An Article," A Professional Journal, XX [1971], pp. 45-50). (Note that brackets, not parentheses, are used within parentheses.)

If a list of references is to be included, it is placed at the end of the text proper and before the sections on personnel and budget. The items

should be numbered and should be in the order in which they are first referred to in the text. In contrast to an alphabetical bibliography, authors' names in a list of references should not be reversed.

In the text, references to the list can be made in various ways; a simple way is to use a raised number at the appropriate place, like this.[1] Such numbers should be placed outside any contiguous marks of punctuation.

The style of the bibliographical item itself depends on the disciplinary field of the proposal. Authors should consult a style guide for their particular field. The main consideration is consistency; whatever style is chosen should be followed scrupulously throughout.

The Personnel Section. This section usually consists of two parts: an explanation of the proposed personnel arrangements and the biographical data sheets for each of the main contributors to the project. The explanation should specify how many persons at what percentage of time and in what academic categories will be participating in the project. Any student participation, paid or unpaid, should be mentioned, and the nature of the proposed contribution detailed. If any persons must be hired for the project, say so, and explain why, unless the need for persons not already available within the university is self-evident.

The biographical data sheets should immediately follow the explanatory text of the "personnel" section, unless the agency guidelines specify a different format. For extremely large program proposals with eight or more participants, the data sheets may be given separately in an appendix. All biographical data sheets within the proposal should be in a common format. A convenient, easily read format is illustrated in the sample on the next page. These sheets should be confined to relevant information. Data on

marital status, children, hobbies, civic activities, etc., should not be included unless the sponsor's instructions call for them. The list of publications can be selective, either on the basis of pertinence to the proposed work or of intrinsic importance. All books written and a selection of recent or important journal articles written may well be listed, but there is no need to fill several pages with a bibliography. The list can be labeled "Selected Publications," "Recent Publications," or "Pertinent Publications," whichever best fits the facts.

The Budget Section. Budgets should be worked out with the staff of the Office of Sponsored Programs (Office of Research Administration). Sponsors customarily specify how budgets should be presented.

The budget section may require only the tabular budget: personnel, equipment, materials and supplies, travel and indirect costs. If the budget is complicated, however, explanations may be in order. The need for consultants, for example, or the unavailability within the university of an item of equipment proposed for purchase may need to be explained. Foreign travel should be specifically detailed and justified, not combined with domestic travel, and the need to travel to professional meetings should be tied as specifically as possible to the proposed project.

The budget should make clear how the totals for each category of expense are reached. Salary information, for example, often needs to be specified in detail: principal investigator (1/2 time for 3 months at $24,000 [9-month appointment]) = $4,000. If salary totals involve two different rates (because of an anticipated increase in salary during the budget period), this should be made clear.

Indirect costs are shown as a separate category, usually as the last item before the grant total. For federal sponsors, indirect costs are figured as a fixed percentage of the total of salaries and wages. Some

sponsors require that indirect costs, or administrative expenses, be figured as a percentage of total direct costs.

The Appendices. Some writers are prone to append peripheral documents of various kinds to their proposals on the theory that the bulk will buttress their case. Reviewers almost never read such appendices, and may resent the padding. The best rule of thumb is: when in doubt, leave it out.

Appendices to proposals are occasionally used for letters of endorsement or promises of participation, biographical data sheets (when there are too many--say, eight or more--to be conveniently placed in the "personnel" section), and reprints of relevant articles.[4]

Writing skills alone cannot compensate for an undeserving project proposal. If the research idea has merit, however, mastering the art of asking and being knowledgeable about the sponsor increase the likelihood of success in generating external funding. Various sponsors have different missions, and, consequently, solicit and read proposals with their special needs in mind. On pages 6 and 7 of the Project Director's Manual (1970) distributed by the University of Michigan, helpful information is furnished about the approach to pursue with mission-oriented and basic research agencies:

> *Approach to take in mission-oriented proposals.* Proposals to the Department of Defense and other *mission-oriented* federal agencies must naturally be tailored to the programs of the agency. They must be explicit as to how the proposed research relates to the mission involved. Quite frequently such proposals are solicited--that is, prepared in response to a Request for Proposal (RFP) or to some other announcement of the agency's intention to support research in a particular technical area. Thus, there is

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[4]With some deletions and minor editing on our part, this material appears in A Guide for Writers of Research Proposals, circulated to faculty members at the University of Minnesota through the auspices of the Office of Sponsored Programs. We are grateful to them for forwarding this pamphlet to us.

no need in this kind of proposal to include extensive preliminary or introductory material about the technical field itself. The proposal is customarily reviewed "in-house" by the agency's own technical staff. Because such proposals are in direct competition with those from other institutions, they should attempt to show the reviewers why The University of Michigan, rather than another institution, can best do the job. The previous successes of the proposing laboratory, the excellence of its staff, the quality of its facilities, etc., are typical points of emphasis in these proposals.

Approach to take in basic research proposals. Proposals to *granting agencies* (e.g., the National Science Foundation, the National Institutes of Health, the National Endowment for the Humanities, the Office of Education, and the various private foundations) are commonly for basic research not tied to a narrowly defined mission. They are usually unsolicited, in that no specific invitations are issued, although deadlines for the submission of applications are established by most agencies. Applications to these agencies may be sent for review to several readers in the applicant's field and in related fields and, in addition, are reviewed by the program officers of the agency. Obviously, then, applicants to such agencies cannot take for granted that all of the reviewers will be expert in the particular specialty of a given application. Especially in the introduction, the applicant should have in mind the non-specialist and clearly spell out the general nature and purpose of the research. In contrast to the solicited proposal, an application to a granting agency usually does not stress the past work and present capabilities of the laboratory or other University unit; the application is "selling" an idea primarily, not an organization. On the other hand, an application should stress any prospective involvement of students. As a rule, granting agencies are interested in the contribution of their programs to the education of students.

Criteria for Proposals

Listed below are the shortcomings of 605 proposals rejected by the National Institute of Health. Such a checklist may prove useful to those preparing proposals. If the proposal can avoid serious criticism on each of these criteria, it may gain favorable review from the readers.

PROBLEM

1. The problem is not of sufficient importance or is unlikely to produce any new or useful information.
2. The proposed research is based on a hypothesis that rests on insufficient evidence, is doubtful, or is unsound.

3. The problem is more complex than the investigator appears to realize.
4. The problem has only local significance, or is one of production or control, or otherwise fails to fall sufficiently clearly within the general field of health-related research.
5. The problem is scientifically premature and warrants at most, only a pilot study.
6. The research as proposed is overly involved, with too many elements under simultaneous investigation.
7. The description of the nature of the research and of its significance leaves the proposal nebulous, diffuse and without a clear research aim.

APPROACH

1. The proposed tests, or methods, or scientific procedures are unsuited to the stated objective.
2. The description of the approach is too nebulous, diffuse, and lacking in clarity to permit adequate evaluation.
3. The overall design of the study has not been carefully thought out.
4. The statistical aspects of the approach have not been given sufficient consideration.
5. The approach lacks scientific imagination.
6. Controls are either inadequately conceived or inadequately described.
7. The material the investigator proposes to use is unsuited to the objective of the study or is difficult to obtain.

8. The number of observations is unsuitable.
9. The equipment contemplated is outmoded or otherwise unsuitable.

INVESTIGATOR

1. The investigator does not have adequate experience or training for this research.
2. The investigator appears to be unfamiliar with recent pertinent literature or methods.
3. The investigator's previously published work in this field does not inspire confidence.
4. The investigator proposes to rely too heavily on insufficiently experienced associates.
5. The investigator is spreading himself too thin; he will be more productive if he concentrates on fewer projects.
6. The investigator needs more liaison with colleagues in this field or in collateral fields.

OTHER

1. The requirements for equipment or personnel are unrealistic.
2. It appears that other responsibilities would prevent devotion of sufficient time and attention to this research.
3. The institutional setting is unfavorable.
4. Research grants to the investigator, now in force, are adequate in scope and amount to cover the proposed research.[5]

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[5] E. M. Allen, "Why are Research Grant Applications Disapproved?" Science 132 (November, 1960): 1532-1534. This journal article is reprinted in the Guide cited previously and the Proposal Preparation Guide distributed at Case-Western Reserve University.

Submitting the Proposal

Most universities have prescribed procedures for the submission of a research proposal in the preliminary and final stages. Before contact is made with a potential sponsor, the administrations recommend that project directors confer with their respective department chairmen, deans or other appropriate university officials and representatives from the Office of Research Administration (this is the most commonly used title).

Departmental approval is almost always mandatory. The chairman is in the best position to judge whether (1) the research shows promise of contributing to the discipline; (2) the researcher can be released from his departmental assignments without seriously damaging the department's program; (3) the project is appropriate for the university to undertake and is compatible with the department's goals and capabilities; (4) the project requires the department to make personnel, space or equipment commitments it would not have otherwise made; (5) the project director has the competence and maturity to direct, manage and comply with the terms of the grant or contract; (6) the research does not conflict with or duplicate research already in progress; (7) project is related to academic program of the department and provides opportunity for undergraduate or graduate research training. How much priority the department chairman assigns to each of these factors depends on a host of circumstances, but some or all of these issues have an impact on his decision to approve unamended, recommend with changes, or disapprove a research project. A department chairman may also suggest an informal session with the college dean.

Faculty members whose research projects involve animals or humans as subjects, possible radiation hazards, or the use of controlled or dangerous substances are usually required to secure approval from internal review committees, the Health Physics office, or a designated university official. If restriction on information or security clearance is a condition of the grant or contract, permission must be given in advance by the appropriate academic committees or administrative officer, usually the Vice President for Research.

Consultation with a staff member of the Office of Sponsored Programs (Office of Research Administration) may be beneficial to a prospective project director. The range of activities and services offered by this administrative unit will be discussed in detail in the following section. In the preliminary stages, a staff representative can offer information about the sponsor and advice about drafting the request. This university office is particulary astute about preparing the project budget and making sure that the proposed project budget adequately covers all direct and indirect costs.

Sometimes the Office of Sponsored Programs will suggest that a faculty member establish informal contact with a sponsor, particularly in the case of private foundations. The Guide used at the University of Minnesota suggests that the faculty member send a letter "outlining the proposed project, suggesting why the foundation should be interested in it, and requesting an appointment to discuss it in further detail."[6]

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[6]The University of Minnesota, A Guide for Writers of Research Projects, p. 16.

The formal procedure for the submission of a research proposal retraces some of the preliminary steps once the researcher is certain of departmental, institute or college approval. Applications must be transmitted through department chairmen to the deans (or his designate) who indicate their endorsement by signing the title pages before forwarding the proposals to the Office of Research Administration. If a researcher holds an appointment in an intercollege research unit, the institute director and his department chairman sign the form, and it is then sent directly to the Office of Research Administration. If the proposed study involves animals, humans, radiation hazards, or special treatments, the appropriate internal review committees must also approve.

A staff representative of the Office of Research Administration is responsible for insuring that the proposal meets all university and sponsor policies and that the request is complete. All approvals must be in order and the budget must be adequate. The staff may consult with a fiscal officer if doubts or uncertainties exist about the budget requests. If the ORA is satisfied that the researcher has complied with all the necessary requirements, the proposal is forwarded to the Vice President for Research.

Princeton University has established a University Research Board that serves as an executive overseer for its Office of Research and Project Administration. The Board is responsible for the solicitation, acceptance, general supervision and administration of research grants and contracts. In addition, the Board conducts a periodic review of sponsored research with departmental representatives. Before formal submission, proposals are reviewed by subgroups of the Board; at least one member selected from the non-sciences and one from the sciences-engineering.

The membership includes six faculty members, the chairman, dean of the graduate school or his representative, treasurer of the university, and the director of the Office of Research and Project Administration. The Board must convey its approval before the Office of Research and Project Administration can finalize the decision. Extensions or budgets of less than $25,000 are processed directly without referral to the Board.[7]

The Vice President for Research has the responsibility for reviewing all proposals to outside agencies for support of research. He must approve any deviations from normal policy and procedures. His signature indicates that the university is willing to undertake research on the basis of the stipulated budget and under the conditions detailed in the proposal. (Some of the research manuals point out that the Board of Regents has the legal responsibility for entering into research grants and contract agreements on behalf of the university.)[8]

Office of Research Administration

The kinds of services, realized and suggested, for this administrative unit rivals the names by which it is known at various universities. For simplification, we have adopted the most commonly used title: Office of Research Administration. Illustrative of the myriad of services such an office can perform is this summarized list from the University of Florida:

(1) Stimulate and assist in providing support for an expanding and balanced research and graduate program;

(2) relieve principal investigators and departments of detailed administrative and reporting duties;

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[7] Princeton University, Rules and Procedures of the Faculty (Princeton, N.J., October, 1971).

[8] University of Washington, Handbook (1972 Edition) Vol. IV, pt. 2:5.

(3) assist in negotiation of contracts and grants with sponsor;

(4) inform deans and directors of new possibilities for grants;

(5) serve as a central records office for grants and contracts;

(6) assist in preparation of proposals;

(7) handle patent matters;

(8) handle project terminations, interim and final reports;

(9) cooperate within university and with state university system to assure that sponsored research program is effectively advancing educational and service objectives of the university and state university system;

(10) maintain contact with other state agencies so that research resources of the university may be utilized by the state of Florida;

(11) recommend policies for the selection of developmental projects to be supported.[9]

Many of the research administration offices help faculty in the drafting, editing and revising of proposals. Such advice and counsel are particularly useful in the preliminary stages. Stanford, Minnesota, and Michigan, among others, employ staff (project) representatives to monitor the activities of a special or group of sponsors. Consequently, the staff are expert in keeping abreast of relevant trends and recognizing new funding possibilities for the university. In addition, they are familiar with the procurement, business policies and procedures of their assigned agencies or foundations. They maintain liaison between sponsors

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[9] University of Florida, "Presidential Memorandum Number 13" (Gainesville, Florida, October 5, 1973) sec. 4.80.

and the university units and can, as part of their duties, intercede on behalf of a faculty member who thinks a response to his proposal is past due.

The University of Massachusetts publishes a Faculty Bibliography, as does many other universities. The dean of the graduate school, in his preface to The Manual for Sponsored Projects (1972-1973), indicated that the Office of Research was hoping to compile a computerized Faculty Interest Index enabling anyone to locate common research interests across the wide range of faculty in the 70 or more departments at Amherst and other campuses.

The Office of Research Development at Michigan State University offers a variety of services in addition to those already described. They will direct faculty to specific persons with helpful information, either on campus or elsewhere. They maintain a file of successful proposals in a variety of fields which can be suggestive and which, with the approval of the author, can be reviewed and studied. As a public relations service, they have recently begun publishing a Directory of Research Competencies which will be used in providing important information about the university for audiences off campus, such as government agencies, foundations, industry and professional associations.[10]

At periodic intervals, the Office of Extramural Support at U.C.L.A. publishes a Research Administration Journal that is devoted to a broad spectrum of topics of interest to the administration and faculty.

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[10]Michigan State University, Sponsored University Programs for Research and Education (East Lansing, Michigan, 1971), pp. 38-39.

Included in its contents are articles contributed by faculty and administrators, reprints of talks by noted people, and a considerable amount of current data on funding trends. The Office has instituted a computer procedure for processing all information relative to awards made by various agencies to the university. As a result, the faculty is continuously kept informed.[11]

All Offices of Research Administration do not render all the services mentioned, but the preceding examples provide a sampling of the possibilities that exist within this type of unit to assist faculty and administrators. By editing, monitoring, publishing, collecting, or performing a public relations service, such administrative units have made their activities indispensable in the functioning of a major research university.

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[11] We thank Robert J. Eveld, Director, for apprising us of the procedures and services offered by his organization at U.C.L.A.

II. Unsponsored Research

Financial Sources

Universities provide financial support for the conduct of research in a variety of ways. Sabbaticals, single quarter (term) leaves with pay, and summer research appointments for faculty along with fellowships, assistantships and grants for students constitute common usages of university funds in support of research activity. Many of these arrangements or honors are awarded on a competitive basis--university-wide, college or department. Depending on the budgetary procedures adopted at the institution, resources for these purposes could be line-item, contained in the departmental instructional budgets, or part of the deans' discretionary funds. Equipment allowances, travel allotments, and differential computer time rates are also forms of institutional support. Listed below with examples are the sources, real or recommended, from which income in support of research can be derived:

(1) direct state appropriations (The University of Kansas receives a yearly amount established by action of the state legislature and the Board of Regents);

(2) earmarked state funds (the University of Utah supports general research with a portion of the monies the state receives from the Federal Mineral Leasing Act);

(3) privately endowed funds (the Hecksher Fund income at Cornell);

(4) dedicated university funds (the University of Michigan Memorial-Phoenix Project awards research support to specific proposals related to the peaceful uses of nuclear energy. The investigations can be social, philosophical, legal, economic, medical, etc.);

(5) special assessments ("Nickles for Know-How" at North Carolina State at

Raleigh, a program in which feed and fertilizer users have voted to have five cents added to the price of each ton of feed and fertilizer sold in North Carolina with the proceeds therefrom being used to support agricultural research);

(6) institutional grants (uses detailed by Oregon State University)
NSF (grant to strengthen general research functions in mathematical, physical, biological, social and engineering sciences as defined by NSF. Can be used for employment of research staff, purchase of research equipment, support of visiting research specialists and conduct of other research related activities);
PHS (grant for emerging opportunities in research, to explore new and unorthodox ideas, to recognize and support scientific talent earlier, and in general to utilize funds flexibly for improving and fostering additional health research consistent with broader academic objectives);

(7) patent income (The University of Massachusetts, Wisconsin and Stanford represent the gamut in patent arrangements. The University of Massachusetts has no policy of its own and has entered into an agreement with the Research Corporation of New York to provide legal and commercial services. The University of Wisconsin has ceded its management responsibilities along these lines to the Wisconsin Alumni Research Foundation. Stanford University directly handles all aspects of patents and inventions. Stanford, after costs, returns one-third of the net royalties to the inventor, one-third to his department, and one-third to the university. WARF and the Research Corporation of New York return about fifteen percent to the inventor and share the additional revenue with the respective universities on an agreed upon contractual basis.);

(8) copyrights, educational materials (an emerging area for income generation; few universities have formal procedures, although many are now in the process of formulating policy);

(9) overhead (a University of Florida self-study group has proposed that overhead be applied to stimulate research rather than being diverted for general purposes).

This is not an exhaustive list of potential income sources for internal funding of research, but it is the commonly mentioned methods which universities employ.

Research Management and Decision Making

Most universities do not tend to make use of internal review boards as "watchdogs" in the acceptance of extramural research grants and contracts. The "day of reckoning" is usually postponed until the outputs of such sponsored research are judged by faculty tenure and promotion committees. If a research proposal raises ethical, moral, or legal considerations, then the decision to accept or reject the offer is shared by the faculty and administration. Nearly all universities have internal review committees to insure compliance with the directives governing the rights of animals and humans as subjects for experimentation. Similarly, the administration engages in the consultative process with faculty when acceptance of the research could compromise the university or its constituencies. Generally, however, universities have adopted a laissez-faire attitude toward sponsored research and exercise a minimal managerial role.

Decisions about the allocation of internal funds seem to be shared extensively with the faculty, for in contrast to sponsored research, the resources are limited and the competition is internal to the institution.

Also, most research proposals are invited on a university-wide basis and no single administrative official is likely to be knowledgeable about all the disciplines incorporated within the university structure. At the University of Wisconsin, for example, the graduate school dean, before making awards for research grants-in-aid and summer or semester faculty salary support, counseled with a committee composed of one associate dean and 35 faculty members who represented a broad spectrum of disciplines, specialties, and sub-divisions of the university.[12] Unfortunately, no details were given about the committee members as to the length of their terms, whether they were elected or appointed, or how the formula is established for representativeness.*

As is true in sponsored research, some of the same key players are involved in the decision-making process for intramural funds. The department chairman must signify his approval, for regardless of who ultimately disperses the funds, nomination must be made through the department. In some instances there is only a two-step progression. The funding for which a faculty member is applying may be allocated by the college dean. For instance, at the University of Michigan, each dean of a health-related professional school (dentistry, medicine, public health) has a National Institutes of Health Research Support Grant from which he can made modest awards for research.[13]

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[12] A mimeographed communication, dated August 24, 1973, was received from Robert M. Bock, Dean of the Graduate School. It was sent to members of the Madison campus faculty and provided information about deadlines and procedures for applications to the Graduate School Research Committee.

[13] The University of Michigan, Project Director's Manual, p. 3.

*See Appendix C.

Universities often decentralize the external funding operation according to the type of aid sought or the derivation of the funding. Again, at the University of Michigan, the Vice President for Research can disburse "seed money" for preliminary investigations that are necessary first steps in securing external sponsorship.[14] At the University of Kansas, the Office of Research Administration administers the General Research Fund. In 1973-74, the amount was approximately $619,000.[15] The university official who has almost no role in sponsored research, but who plays an important part in the disbursement of intramural research funds is the dean of the graduate school. Regardless of where the authority is vested for the allocation of internal research support, faculty committees share in the responsibility.

Eligibility and Support

Few policies are consistently practiced by all universities with regard to the criteria for eligibility or the list of allowable expenses. The amounts and sources of internal funding as well as the philosophies governing the allocation of these resources help determine the candidates for selection and the level of subsidy. The three universities described below each attach different conditions to the awards. According to the introductory statement describing the Faculty Research and Professional Fund at North Carolina State University, its major objectives are to bring encouragement and support to the intellectual interests of the university faculty so as to enhance their opportunities for professional

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[14] Ibid., p. 4.

[15] University of Kansas, "Invitation to Submit Proposals," mimeographed (Manhattan, Kansas, Office of Research Administration, December 1, 1973), p. 1.

growth and teaching enrichment. In addition, the Fund serves a "pump-priming" function by supporting, at a modest level, research projects that appear promising but are without other visible means of support in their early stages. (This is comparable to the distribution of "seed money" by the Vice President of Research, University of Michigan, that we described on Page 30.) Highest priorities are given to research proposals from young faculty. Graduate students, administrators, and well-established scholars and researchers are ineligible. The awards are modest, usually no more than $1000. Financial support may be requested for any item normally appropriated in a research budget except the salary of the principal investigator.[16]

The general research grants provided for by state appropriations at the University of Kansas are awarded on some of the same bases as those at North Carolina State University. In both cases, the applications are addressed to the Office of Research Administration (or the equivalent) for review by faculty committees, but at Kansas, proposals are solicited twice a year. Graduate students are excluded from consideration. However, all members of the University Faculty Senate, Laurence campus, are eligible, although the committee is more disposed to support beginning faculty. Proposals for research in innovative and improved instructional techniques are welcomed, but applications for projects that can be supported externally are regarded unfavorably unless the researcher has explored outside sponsorship first. Unlike North Carolina State, Kansas will permit up to two months' salary for the principal investigator.[17]

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[16] Details about the Fund were furnished by Dr. E. W. Glazener, Associate Dean and Director of Academic Affairs, School of Agriculture and Life Sciences, North Carolina State University at Raleigh.

[17] University of Kansas, "Invitation to Submit Proposals," pp. 1-6.

This last policy guideline may be directly related to the amount of state funding available. None of the awards at North Carolina State exceeded $1000. Last year Kansas made two awards in excess of $4000. The University of Kansas does not ordinarily consider equipment requests; North Carolina State University will authorize payments for special equipment costing less than $500.

Cornell University operates a Small Grants Program with income obtained from the university budget, the Cornell Research Foundation, the Hecksher Fund, and institutional grants from PHS and NSF. The research Grants Committee makes two types of awards: grants for certain direct costs of research projects and summer research support in the form of fellowship awards. Outstanding graduate students are eligible for the first kind of support.[18] This represents a departure from the practice at the other two schools.

One feature in the awards does tend to be universal: the duration of the grant. All successful proposals are funded for one year. Several universities will permit a renewal, but the applicant must show significant progress.

Policy Guidelines

Policies may be defined as "general statements that guide decision making in the organization."[19] Some of these policies have already been articulated. Assignment of a higher priority to a research proposal emanating from a junior faculty member is an example, as are determining allowable budget items, setting time limits, or defining types of in-house

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[18] Cornell University, "Manual for Policies and Procedures for Sponsored Projects," mimeographed (Ithaca, New York, Office of Academic Funding, October 10, 1972), p. 10-11.

[19] Leonard J. Kazmier, Principles of Management (New York, New York: McGraw-Hill Book Company, 1969) p. 28.

sponsored research. Even the use of faculty committees in an advisory capacity by the responsible university official constitutes policy. Universities can and do exercise many policy options in establishing criteria for intramural research, as our illustrations demonstrate.

In addition to a contingency fund (The President's Reserve), the University of Washington has established The Institutional Fund and a Graduate School Reserve Fund, each with a different mission and a different set of guidelines. Details about the operations of these two sources of research support appear below:

> The primary objective of the Institutional Fund is to encourage the development of new, sometimes experimental, programs and the significant expansion and improvement of existing programs by providing support for additional staff, equipment, or facilities. Highest priority is given to proposals seeking to develop programs and facilities which meet broad University, college or department needs. Accordingly, proposals for the support of specific research projects receive a lower priority.
>
> The GSRF functions primarily to assist individual faculty members, graduate students, and postdoctoral appointees to carry out significant research. Interdisciplinary research and scholarly collaboration among professors may also be encouraged and assisted.
>
> Salary, usually for one month during the summer, may be provided to selected younger members of the faculty who desire to conduct research. Awards are made on a competitive basis and are intended to advance research which has already been carried to a significant stage. Preference is given to assistant professors in the humanities, arts, and social sciences (in view of the relative scarcity of extra-university funds to support research in these areas). Awards will be made only infrequently to associate professors, and almost never to full professors or to those who received awards for the previous summer.[20]

Emphasizing program rather than individual project support and according preferential status to young faculty in the disciplines that cannot easily generate outside support are policy possibilities that have not been previously explored.

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[20]University of Washington Handbook (1972 Edition) Vol. IV, Pt. IV: 31-32.

Changes in Ranking of 40 Institutions Conferring the Largest Number of Ph.D.'s in the Sciences and Engineering, in terms of Number of Ph.D.'s Conferred and Amount of Federal Obligations Received

Rank in order of Ph.D. degrees conferred			*Rank in order of total federal obligations*[1]	
1970-71	1962-63		1970-71	1962-63
1	1	University of Illinois	6	8
2	2	University of California-Berkeley	10	4
3	3	University of Wisconsin	3	11
4	7	University of Michigan	4	2
5	11	Stanford University	7	7
5	15	Cornell University	17	12
7	5	Purdue University	40	27
8	4	Massachusetts Institute of Technology	1	1
9	8	University of Minnesota	2	9
10	20	Michigan State University	30	29
11	14	University of California-Los Angeles	9	10
12	10	Ohio State University	15	19
13	6	Harvard University	8	5
14	22	University of Washington	5	15
15	9	Columbia University	11	3
16	18	Pennsylvania State University	39	31
17	13	Iowa State University	56	45
18	17	University of Texas	38	20
19	23	Northwestern University	44	22
20	12	University of Chicago	20	6
20	16	New York University	18	13
22	25	University of Pennsylvania	16	17
23	49	University of Missouri	22	41
23	[2]	Case-Western Reserve University	42	[2]
25	27	University of Maryland	28	33
26	43	University of Tennessee	35	38
27	54	Texas A & M University	46	44
28	40	University of Florida	41	37
28	24	Indiana University	31	34
30	64	University of Arizona	53	62
31	21	Yale University	19	16
32	19	Princeton University	63	24
32	44	North Carolina State University-Raleigh	51	54
34	39	University of California-Davis	52	64
35	34	University of Colorado	23	26
36	77	University of Massachusetts	78	[3]
37	42	Oregon State University	69	57
38	45	University of Southern California	24	35
38	38	University of Kansas	57	53
40	33	Duke University	26	32
40	28	University of Iowa	37	39
42	30	Louisiana State University	21	55
43	37	University of North Carolina-Chapel Hill	25	40
44	29	Rutgers-The State University	48	51
47	32	University of Pittsburgh	33	18
49	36	University of Utah	32	42
54	31	Johns Hopkins University	14	14
54	26	California Institute of Technology	45	43
57	35[4]	Carnegie-Mellon University	90	77[4]

[1] Includes funds for medical schools, but not FFRDC's.
[2] Separate institutions in 1962-63.
[3] Ranked below 100.
[4] Carnegie Institute of Technology in 1962-63

Source: National Science Foundation

UNIVERSITY RESEARCH POLICY RESPONSES

I. UNIVERSITIES FORWARDING GUIDELINES (31)

Name of Institution	Correspondent
University of Missouri	Dr. Lloyd Berry Dean of Graduate School
Michigan State University	Dr. Milton E. Muelder Vice President for Research
Yale University	Dr. Richard N. Cooper Provost
University of Massachusetts at Amherst	Dr. Pat W. Camerino Associate Graduate Dean, Research
University of Maryland	Dr. David S. Sparks Dean for Graduate Studies
Harvard University	Dr. M. C. Barstow, Jr., Director Office for Research Contracts
North Carolina State University	Dr. Rolin F. Barrett Assistant Dean, Research Administra
University of Minnesota	Dr. Luther J. Pickrel Associate Dean Research
The University of Iowa	Dr. D. C. Spriestersbach Vice President and Dean
Princeton University	Dr. Richard A. Rossi, Director Office of Research
The University of Tennessee	Dr. W. A. Goodwin Dean for Research
University of Pennsylvania	Dr. John N. Hobstetter Vice President for Research
Massachusetts Institute of Technology	Dr. Albert G. Hill Vice President for Research
Case-Western Reserve University	Dr. Robert H. Thomas Vice Provost
The University of Michigan	Dr. James E. Lesch Director of Research Development

I. UNIVERSITIES FORWARDING GUIDELINES CONTINUED

Name of Institution	Correspondent
Cornell University	Dr. Jack W. Lowe Associate Director of Academic Funding
New York University	Dr. Sidney G. Roth Vice Chancellor for Federal Relations
University of Washington	Dr. George W. Farwell Vice President for Research
University of Kansas	Dr. William J. Argersinger, Jr. Vice Chancellor for Research and Graduate Studies
The University of Texas at Austin	Dr. George R. Blitch Director, Office of Research Management
California Institute of Technology	Dr. Allan J. Lindstrom Sponsored Research Administrator
University of Florida	Dr. George K. Davis, Director Division of Sponsored Research
University of Wisconsin - Madison	Dr. Eric Rude Associate Dean - Graduate School Director - Office of Research Services
Oregon State University	Dr. Roy A. Young Vice President for Research and Graduate Studies
Stanford University	Dr. D'Ann B. Downey Assistant Sponsored Projects Officer
University of California - Los Angeles	Dr. Robert J. Eveld Director
University of Utah	Dr. Nina Nichols Administrative Assistant
University of Pittsburgh	Dr. Edward Joseph Shoben, Jr. Associate Provost and Graduate Studies and Research
Purdue University	Dr. F. N. Andrews Vice President for Research and Dean, Graduate School
Purdue Research Foundation	Dr. J. L. Waling Director, Division of Sponsored Programs

I. UNIVERSITIES FORWARDING GUIDELINES CONTINUED

Name of Institution	Correspondent
University of Colorado	Dr. H. D. Roark Director, Office of Contracts and Grants
University of California - Berkeley	Dr. Sanford S. Everg Dean of Graduate Division

II. UNIVERSITIES WITHOUT GUIDELINES (5)

Name of Institution	Correspondent
Indiana University	Dr. H. Shull Vice-Chancellor
The University of Arizona	Dr. A. Richard Kassander, Jr. Vice President for Research
Louisiana State University at Baton Rouge	Dr. James G. Traynham Vice-Chancellor for Advanced Studies and Research and Dean of the Graduate School
University of Chicago	Dr. John T. Wilson Provost
Iowa State University	Dr. D. J. Zaffarano Graduate Dean

III. UNIVERSITIES ESTABLISHING GUIDELINES (10)

Name of Institution	Correspondent
Rutgers University	Dr. David Pramer Director of University Research
Texas A&M University	Dr. Robert R. Berg, Director Office of University Research
University of Southern California	Dr. Jack M. Nilles Director, Interdisciplinary Programs
University of North Carolina	Dr. George R. Holcomb Dean of Research Administration
Carnegie-Mellon University	Dr. H. W. Paxton Director of Research
University of Illinios - Urbana	Dr. George A. Russell Acting Dean, Graduate College and Associate Vice-Chancellor, Research

III. UNIVERSITIES ESTABLISHING GUIDELINES CONTINUED

Name of Institution	Correspondent
University of California at Davis	Dr. Allen G. Marr Dean, Research Development
The Johns Hopkins University	Dr. Alfred P. Ashton Director, Office of Sponsored Research Administration
Ohio State University	Dr. Jules B. La Pidus Associate Dean, Graduate School
Northwestern University	Dr. Earl J. Freise Assistant Director ORSP

APPENDIX B

A. Interview Summaries (University of Michigan)

(1) James E. Lesch, Director
(ORA) Office of Research Development & Administration

(2) Dr. Charles Overberger
Vice President for Research

(3) Mr. Donald Lentz
Assistant to the Dean, Medical School

(4) Dr. William Lasher
Acting Director, Institutional Research

B. Application for Grant or Contract (EXHIBIT A)

C. Letter Convening Research Seminar (EXHIBIT B)

D. List of ORA Reports (EXHIBIT C)

E. "Reporter" Semi-monthly Research Bulletin

Q7. Do you give any attention to the substantive content of the investigation?

We have not found it necessary to do so in the past. I do feel that people on our staff should have a technical base in the fields they work with: social sciences, engineering, or physical sciences. This would be valuable not so much in monitoring the projects as in contacts with the departments in initiating new work.

Q8. How is the direction of research activity determined?

At the present time we don't have any formal means of doing this. My staff disseminates information on the interests of funding agencies, and we, of course, keep alert for RPF's requested proposals for funding.

Actually, we assume that departments or groups of faculty are making periodic summaries of the "state of the art" to block out research planning areas. The importance of this kind of analysis has increased in recent years, and we are gradually moving into this ourselves. For example, we have had a (Exh. B) series of meetings with interested faculty around two major areas of interest. One of our leading chemists (Katz) has a long-standing interest in coal gasification, but investigations in this area are filled with opportunities in engineering and geology as well as in chemistry. We have conducted state of the art meetings to try to identify fruitful areas for investigation. A similar activity has been undertaken with the "substance abuse program." Social, medical, and justice agencies in this part of the state have found a need for considerably more information on drugs. Two of my project directors have been calling together interested faculty and circulating minutes of the meeting in an exchange which will probably result in a series of research proposals from several sources. Normally, there is a very loose screening by department heads of project proposals, again mostly in terms of available space, time, and physical resources.

Q9. Your manual describes a wide range of support functions provided by ORA. Are there any other informal means of encouraging research activity?

The main support functions of ORA are aimed at getting the project off and running. We provide editorial aid with the preparation of the proposal including informal liaison with the possible sponsors to determine the points of emphasis they seek. We also provide editorial assistance with final reports on the project. We do not help with articles or books not directly associated with the project performance. We support the project with information feedback about the state of accounts and the necessary procedures including purchasing and personnel management to reduce the burdens of these items on the investigator. Informally, we trace the process of project review as it goes through the government or other agency and usually get advance word on funding.

Q10. Do you see any problems in your present method of operation?

The problem with our posture of response to faculty initiated research is that it does not allow for the fullest use of the knowledge that is available in ORA. While we have considerable liaison and circulate a great deal of information, there are at least two things that could be done better: the first is the one we have already mentioned, pulling together individual interests around cooperative research themes; and the second is to keep track of not only equipment and facilities, but also faculty interests around the campus so that we can channel interests of funding agencies to the right person the first time, and so that we can bring two people with similar interests together more effectively.

Q11. Are there any proxies or indicators of the management type that you can use to analyze the project proposal? I mean such things as ratio of professional time to technical time, or cost benefit indicators.

We have no orderly system of using such indicators. The kinds of reports we prepare are listed on the attached sheets, and they are reflective of the total picture, but we have not used them for evaluation or screening of proposals. Actually, we hope to develop management indexes over the next few years.

Q12. Is there any summary of the project or review after it is completed?

There is no post-facto review other than the preparation of the final report for several reasons: (1) It would have a low value in terms of internal management and would represent additional cost. (2) Peer judgment within the college or department takes care of much of this kind of evaluation. (3) Extra-mural professional evaluation of the man's work is part of the department knowledge, and we have no need of it.

Q13. Do you make any summary of the project results and try to feed them into any of the scientific information systems, regional or national, such as SIS?

Such summaries, or abstracts, are prepared by the investigator. We are under no pressure to participate on a large scale in these information systems, and we do not use them for any particular purpose.

I would like to have an internal information system but simply to locate capabilities, interests, resources, and ongoing activities that might be encouraged into other projects or combined in special ways.

Q14. What reports do you generate for your own use?

See attached sheets. (Exhibit C)

NSF Management Research Project

Interview Report

February 4, 1974

The University of Michigan

James E. Lesch, Director
Office of Research Development and Administration
(Formerly ORA)

NOTE: This is the principal agency through which proposals are submitted to external funding agencies and through which research-in-progress is managed to the point of completion.

Q1. The universal unit of research activity for your organization appears to be the "project." How is this defined? What if there are two projects dealing with the same subject? How do you treat many projects conducted by a single center or institute?

The project as a unit of research activity is defined as a discreet budgetary item organized around the performance of a set of research tasks. There is no attempt anywhere in ORA to evaluate critically the scientific or scholarly content of a project. The concern is with the performance factors, that is, the management of funds, the use of personnel, the maintenance of an appropriate schedule and proper reporting to the sponsor or to other agencies of interest. Projects are almost always identified with a single faculty member as the principal investigator who is responsible for all of the substantive features of the research, what we call "technical responsibility." A parallel management responsibility is located with a project director in ORA who monitors the use of funds, the timing of reports and maintains routine liaison with the sponsoring agencies. Where funding is complex a project coordinator may also be introduced.

Because the research project is a budgetary unit, it is possible to have several projects with the same focus or a variety of projects under a single organization and still keep track of each one.

Q2. Are there open "programs of research?"

Within ORA there are no definitely supported programs of continuing research. There are development funds available for preliminary explorations into technique, design, or basic equipment. These rarely exceed $1,000. Elsewhere in the university structure there are research organizations capable of sustained programs of research. The Highway Safety Research Institute, for example, operates on a number of sustaining grants and certain laboratories in the Medical School, notably the Tissue Culture Center and the Radioactive Isotope Center. ORA has the specific function of management support to initiate and sustain research that is or may be funded by extramural agencies.

Q3. In one policy statement there is a phrase that research is "decentralized intentionally" at the University of Michigan. What does this mean?

This means that the initiative for generating proposals and developing good ideas into research designs rests with the faculty members. Likewise the faculty are responsible for managing the projects and for performing the technical aspects. So, decentralization means dispersion of initiative and responsibility but not funding. There are no block grants to departments or individuals, and control of funds remains at the central agencies.

Q4. What about departmental research?

Departments do have a certain amount of slack in terms of equipment and time that can be dispersed among the faculty members for developmental research activity. We do not keep track of this centrally except through the faculty activity reports, the form B's, which describe percent of effort, and report the budgetary source for income for each faculty member. Eventually we will have a comprehensive report of departmental research, but the institutional research office has just begun work on this.

Q5. What descriptors are used for research projects, and how are they standardized?

The descriptive items we are interested in are based on space, personnel, and support requirements. We do not keep orderly track of the substance of proposals, that is, the technical content. We do have two items on our 7679 forms which deal with the outcomes of the project, (Exh. A) asking "educational implications of the project" and the kinds of publications to result. Follow-up studies have shown a good payoff on the intentions expressed on these forms.

Q6. What "indicators" do you use to keep track of projects?

Our primary concern is with management proxies to assist in an analysis of the performance. We are not concerned with technical, scholarly, or scientific content. There is a kind of a flow to each project as it cranks up, reaches a peak, and then winds down. This flow is reflected not only in the investigation but by the use of funds, the generation of reports, and the amount of time the people involved are spending on it. All these are reflected in management proxies, for example, in the form of charges against computer time, laboratory supplies and equipment, and personnel encumbrances. The project director or coordinator can tell if the project is moving by observing these proxies.

Q15. Can you give me any information about the use of internal funds to sponsor research?

There is no single office that disperses general funds for research. We have small amounts for preliminary development grants. The Rackham School of Graduate Studies has a program of faculty fellowships and grants. Funds for this are drawn from institutional allowances, from the Rackham Endowment, and from several other sources to give a substantial program of awards. The Medical School has general medical support grants. IST (Institute for Science and Technology) has some funds to develop mission oriented proposals. Only two of these agencies use a peer review system, the Rackham grants and the Medical School.

Almost all internal support is regarded in the light of several possible ends: (1) initial support that will very probably lead to funded proposals; (2) high risk inquiries that <u>might</u> lead to funding; (3) support for scholarly enterprises that cannot be funded elsewhere, such as the Middle English Dictionary, certain archeological work, and some history of art studies; a miscellaneous group of projects that involve professional development, matching funds for such things as Social Science Research Council grants, subventions on publications, and a variety of other one-shot activities.

The interview with Mr. Lesch emphasized the procedural aspects of research management in one setting. The meeting with Dr. Charles Overberger, the Vice President for Research, concentrated on the broader aspects of research policy and upon an overview of research activities throughout the University.

NSF Management Research Project

Interview Report

February 4, 1974

The University of Michigan

Dr. Charles Overberger
Vice President for Research

NOTE: In contrast to Mr. Lesch, Dr. Overberger referred to "programs" of research in the University rather than projects. Some of the conversation touches on reporting of how things are done, but much of it deals with speculation as to where they might be moving next. The focus of his interest was clearly on the next steps and future developments rather than on procedures.

Q1. With respect to research policy for the University as a whole, has there been any effort to define a configuration of interests or a research policy profile to pull together the areas of emphasis?

There is no comprehensive policy for research as yet. We have a Research Advisory Council which includes the Graduate Deans, Deans of the Colleges, and others; and we have a Research Committee of the Faculty Senate. Both of these have occupied themselves with defining and stating very fundamental guidelines for research activity such as the treatment of human subjects in experimental settings, the care and use of laboratory animals, prohibitions against research designed primarily to kill human beings, and the meaning of confidentiality and secrecy in research activity. These represent fundamental guidelines that tend to run for long periods of time. The second kind of research policy, that which deals with a profile of university interests in the various fields of knowledge, has not been attempted. There are two reasons for this. First, because research is rooted in the faculty and the initiative lies there, there is no particular value to policies that would specify one kind of interest or another. It isn't so much necessary to manage research as to encourage and support it. The second reason is that we have a variety of organizational forms into which research activity is set. These units have inherent characteristics of their own, and they provide a repository for different kinds of research. IST, the Institute for Science and Technology, does mission oriented and contract work. The Highway Safety Research Institute does contract work and grant supported program work in a particular area, but is quite capable of dealing with psychological and social issues such as drunk driving as well as with technical problems of tire construction and road design. We have the Great Lakes Research Institute which has undertaken a variety of projects, and right now we are looking into it as a possible location for a series of environmental studies. The Institute for Social Research (ISR) operates with a great deal of autonomy on both grant and contract research that totals about 8 million a year. The Rackham School of Graduate Studies from its endowment and from some of the University's general funds supports research by individual faculty members and by graduate students. And finally, there is ORA which takes care of most of the sponsored research projects.

The point is that this varied organization gives us places for research activity of almost any kind, so we are in a position to respond to new leads and new areas of study.

Q2. Are these varied organizations brought together in any kind of a council setting?

No, there has been no effort to do this, although there is a great deal of informal exchange among the various groups. We do think that in the very near future some formal method of interchange will have to be developed.

Q3. Is there any attempt to distinguish the different purposes for research?

You will notice that each of these units I've mentioned has a different pattern of emphasis in its own activities. Rackham emphasizes research in professional development, ORA represents relationship with sponsors, and IST represents mission oriented contract research. Naturally, all of them have secondary purposes involving education and contributions to knowledge in the field.

Q4. Is there any periodic program review or research activities review?

In some units the reviews conducted by the sponsors provide sufficient feedback to tell what the state of the unit is. In others, the simple success rate of proposals is sufficient. In the case of the ISR, the Institute for Social Research, there is an internal self-evaluation which is highly effective. Specific peer group evaluations for internal funding are used in only two places. The Rackham School of Graduate Studies used boards of reviewers to select the recipients of faculty grants and fellowships. The Medical School uses some kind of a peer review for the use of its internal research funds. We have not found it necessary to use this kind of evaluation for research.

Q5. Have you developed a research information system to keep you informed of research around the University?

This has been discussed quite often with the institutional research people, and eventually we will arrive at some kind of a simple summary of ongoing research. It will have to come as part of a total information system and to develop it exclusively for research would be costly.

Q6. Some of the recent studies have emphasized the distinction between research and the process of innovation. Have you taken any steps to maintain or develop the interests of the University as the project moves into the innovative stages and toward the market?

We have just completed a comprehensive review of our patent policy and the policies related to royalties, in general tightening them up. We also

have negotiated development contracts with Batelle Institute and others so that we can share in some of the pay-offs that might result from fundamental research conducted here. A case in point, and it has gone much slower than we hoped, is holography which has been under examination here and at Batelle for perhaps ten years.

NSF Management Research Project

Interview Report

February 4, 1974

The University of Michigan

Mr. Donald Lentz
Assistant to the Dean
University of Michigan Medical School

The Medical School receives an outright grant from the National Institutes of Health based on the total dollar volume of health and health science projects in the University. These funds are at the disposal of the Medical School, and they are used to support individual faculty application. The proposals are expected to be in areas that have long-range application. Requests are submitted via the department head to the dean. The dean, the associate deans, and the assistant dean review these and approve them for not longer than one year of funding. They are not generally renewable and proposals funded from extra-mural sources are expected to result. In only two cases, the Tissue Culture Center and the Radioactive Isotope Lab, are funds committed on a long-term basis. The Tissue Lab will be only 50 percent funded for the coming year. The chairman of the department gives a critical examination to the proposal, and his endorsement is not questioned. The only review for projects is a glance at the GMS report as it is turned in and a look at the publications that result. Substantial review is taken care of by rather thorough departmental reviews every five years or when the chairman changes. These reviews are very complete including research activities, clinical performance, personnel performance, and budget activity. The Review Committee is drawn from other departments entirely. Occasionally it is necessary to bring in an external consultant to examine some specialized aspect of departmental operations. Self-evaluations are not used.

Some difficulty is encountered with the Mental Health Research Institute which stands apart from the medical program and the Speech and Hearing Institute which is also specialized. Here an External Review Panel is put together. Again, research is not reviewed as a separate activity.

Q. Do you make any critical review of individual projects?

That would be nearly impossible with 1400 projects running each year with a duration of only about 12 months. We could not review the proposals nor would it be possible to make a post-facto review of performance. The practice is, therefore, to review the performance of the department as a whole of which research activity is an integral part. Because research has generally been well funded and proposals get a high rate of acceptance in medicine and allied health, we have not had to develop any specialized procedures.

NSF Management Research Project

Interview Report

February 4, 1974

The University of Michigan

William Lasher
Acting Director of Institutional Research

Q1. How much interest has there been in developing a research information system that would provide a summary of ongoing research and enough indicators to allow for analysis of research activity?

This is very much in the discussion stage. We have just completed a full scale development in the instructional area and are still completing comprehensive faculty activity analysis. Our reviews of faculty activity do specify the share of time and budgetary source for research. We have not yet begun to aggregate this data in usable form.

Q2. Is WICHE doing anything in this area?

As you know, they had started on an outcome study a year and a half ago and it has not yet moved beyond the exploratory stage.

Q3. Do you feel that a research information system would be useful?

It would probably be useful to have a periodic summary of all the research going on in the University. A system for accessing this file by the topic with the output in terms of a brief description of the projects would have some value but the cost of producing such a scheme would have to be weighed very carefully. We are probably some distance from developing this kind of data file because of the high cost, and under present circumstances, its low utility. We are coming at all of these questions by another avenue as Jim Lesch probably told you. The Program Evaluation Committee report developed by one of the major University committees has just been completed and probably will be the basis for much of the evaluation you described.

Proposal no. ORA-_____

Date _____

The University of Michigan

APPROVAL OF APPLICATION FOR GRANT OR CONTRACT

(See back of form for instructions.)

- ☐ Research program
- ☐ Instructional program
- ☐ Facilities request
- ☐ Fellowships or traineeship
- ☐ Res. career dev. award
- ☐ Service program
- ☐ New program
- ☐ Continuation acct. no.: _____
- ☐ Competing renewal
- ☐ Non-competing renewal
- ☐ Research classified

to be submitted to: _____
(proposed sponsor)

Project director _____ Department or unit _____

1. **Major fields of study to which project is related:**

   Code nos. _____ _____ _____ _____ _____ _____ _____

2. PROJECT TITLE _____

3. Purpose or objective _____

4. Proposed period from _____ to _____ Total cost: $_____

5. Educational implications of the project

   ☐ Student research experience ☐ Initiates research in new field ☐ Other_____

   ☐ Will contribute to educational course material ☐ Basis for doctoral thesis

6. **Publication to result:** ☐ Scholarly journal ☐ Book ☐ Thesis ☐ Report to sponsor ☐ None

7. **Does the proposed study involve human subjects:** Yes ☐ No ☐

   If yes, Human Subject Review Committee approval date:_____

8. Effect on faculty, staff, and students:

   a. The following teaching faculty members, other than the project director, will participate.

Name	Rank	Nature of participation
_____	_____	_____
_____	_____	_____
_____	_____	_____

   b. Number of *additional* personnel to be employed by the University:

   Professional personnel: _____

   Technicians, office personnel, etc: _____

   c. Number of students to participate: Graduate:_____, Undergraduate:_____

   d. Postdoctorals involved: No.:_____ Names:_____ _____

9. Effect on University facilities:

   a. Is space available? Yes ☐ No ☐

   If yes, Bldg.:_____ Room:_____ _____
   (approved)

   Is this space adequate for the period of this proposal? Yes ☐ No ☐

   Will this space still be available in view of commitments in other proposals? Yes ☐ No ☐

   If space is *not available*, how much new space will be required?_____ sq. ft.

   b. Is this space adequate for future requirements of this program as you now understand it? Yes ☐ No ☐

   If space is *not adequate*, how much will be required?_____ sq. ft.

   c. Space renovation: $_____ UM account no.:_____ _____
   (approved)

Proposal no. ORA-_____

Date _____

d. Will acquisition of major equipment items require installation and building modification at cost to the University? Yes ☐ No ☐

e. Is special data processing or computing equipment required? Yes ☐ No ☐

f. Will Computing Center services be required? Yes ☐ No ☐

10. Is additional office equipment required for this project? Yes ☐ No ☐

Is it provided for in the proposal? Yes ☐ No ☐

If not, indicate cost and University source: $_____UM Account No.:_____ _____ *(approved)*

11. Is work to be performed off University property (exclusive of field trips)? Yes ☐ No ☐

If yes, indicate location and duration:_____

12. Does the work proposed have international aspects? Yes ☐ No ☐

If yes, indicate general nature: _____

13. Subcontracts: Amount $_____ Subcontractor:_____

Sole source: Yes ☐ No ☐ Purpose:_____

14. Summary of proposed budget:	Total:	Sponsor:	UM sources:	Acct. no. for UM sources:	Approved
Salaries and wages	$_____	$_____	$_____	_____	_____
Employee benefits	_____	_____	_____	_____	_____
Supplies	_____	_____	_____	_____	_____
Equipment	_____	_____	_____	_____	_____
Travel	_____	_____	_____	_____	_____
Subcontracts	_____	_____	_____	_____	_____
Other (itemize under notes)	_____	_____	_____	_____	_____
Total direct costs	_____	_____	_____	_____	_____
*Indirect costs ____% of S&W ☐ TDC ☐	_____	_____	_____	_____	_____
TOTAL	$_____	$_____	$_____		

UM cost-sharing to show in proposal: $_____ or ____% of total cost

15. Has the proposed program been endorsed by any University committee? Yes ☐ No ☐

16. NOTES:

* Explanation if other than established rates

_____ *(Requested by: Project Director)*

_____ *(Fiscal/Legal review)*

_____ *(Endorsed by: Dept. or Unit Head)*

_____ *(Office of Research Administration)*

_____ *(Approved for School/College by: Dean)*

_____ *(Approved for the University by: Vice-President)*

(EXHIBIT B)

AN OPEN LETTER TO THE UNIVERSITY FROM
THE VICE-PRESIDENT FOR RESEARCH
CONCERNING ENERGY RESEARCH

Dear Colleague:

Many members of the faculty and I have discussed the University's relationship to the energy crisis and what we might do to stimulate greater University research initiatives in this area. A number of projects and activities bear a direct or potential relationship to the use and conservation of energy, but we have so far not examined these activities as a whole to see how they might be built upon. We have an obvious responsibility to use our resources in the best way possible and without delay to help meet this world-wide problem. And our first step, I am sure you will agree, is for us to define and evaluate what these resources are and to determine how they best can contribute to local, state, and national efforts.

A start has been made. Besides several individual discussions, we have held one meeting of those persons whom we could identify as being most concerned with hydrogen energy research. Also, members of the administration of The University of Michigan and of Michigan State have met in Lansing with the director and other members of the Michigan Department of Commerce to discuss how cooperative efforts by the state, universities, and industry might be brought about and facilitated.

We propose now to institute a series of faculty seminars for the purpose of disseminating information, arriving at common views, and planning action. To date, there has been considerable faculty interest in work related to (1) the gasification of coal, (2) the use of hydrogen as a fuel, and (3) solar energy. Though we may use these three topics as foci for our early meetings, other topics are expected to be developed once we are drawn together. We are particularly interested, for instance, in drawing upon the University's strong social science expertise to study the social implications of our energy crisis, to evaluate the utilization of existing sources of energy in collaboration with technical colleagues, and to develop policy recommendations concerning them.

The first seminar is scheduled for 7:30 p.m., Tuesday, January 22 in the Rackham amphitheater. I will chair it and will report briefly on the University's activities in this field so far and on our tentative plans. Then Professor Donald Katz will give a paper entitled, "An Overview of Energy Research," and will include special references to the gasification of coal. A discussion will follow both of the particular issues raised by Professor Katz and of the more general problems to which we wish to address ourselves. If you have an interest in the emergent problems in energy research, or know of others who do, I urge you and them to attend. It is important for you to help us start this effort in the right direction.

Sincerely,

Charles G. Overberger

CGO:jd

(EXHIBIT C)

LIST OF REPORTS

OFFICE OF RESEARCH ADMINISTRATION
(OFFICE OF RESEARCH DEVELOPMENT AND ADMINISTRATION)

UNIVERSITY OF MICHIGAN

O.R.A. Report	Content
1. Volume of Research Source of Funds (Annual)	Expenditures by major groupings of sponsor.
2. Volume of Research source groups (Annual)	Same as above by broad groups, such as US Govt, Industry, Etc.
3 Volume of research schools, college, and dept. (Annual)	Same as above, by University unit
4 Volume of research-broad areas (Annual)	Same as above, by six groupings of University units Examples - Engineering, Social Sci, etc.
5 Analysis of Volume of Research (Annual)	Type of expenditure (salary, travel, equipment) by Federal + Non-Federal. Source: Financial Analysis (one page)
6 Support of research - Defense and Non-Defense. (Annual)	Expenditure by defense sources (one page)
7 Volume of Research Industrial Research Expenditures (Annual)	Total of Industry sources, added each year to totals from 1920-21 (one page)
8 Volume of Research University-wide pre-paid participants (Annual)	Count of personnel by teaching, research, non-academic, and students engaged in research. Information is available in academic and personnel information systems, using account numbers from accounting system. (problem with pool accounts-time keeping data retention)
9 Proposal Activities (Annual)	One page summary of proposals made, dollar amounts, and % acceptance.
10 Monthly report of research activities (Monthly)	I. Proposals processed through ORA II. Sponsored research volume III. Estimated volume of all University research a. Fiscal year 1969-70 b. Latest Rate (For 12 months) (one page report)

	O.R.A. Report	Content
	Semi-Annual Report of Sponsored Research Projects (Semi-Annual)	List by research director within department of active and inactive projects. Acct. No., project director, project name, sponsor, budget duration, budget amount, project-to-date expenditures, (Dept Code).
2	Sponsored accounts-expenditure monitoring (Monthly)	Lists accounts in financial trouble (By Account Number)
3	Account expiration tickler system (Monthly	List by sponsor of all accounts, giving account number, starting & ending date, sponsor.
4	Active training grants supported by Federal Govt. (Annually)	List by department, of all training grants, giving acct. numb, grant & sponsor, project director, subject field, time period, no. of students, dollars by expenditure type.
15	DOD and NASA Plantwide Economic Report (Semi-Annual)	Counts of scientists and engineers working on DOD, NASA, other Gov't and commercial business, and percent on prime contract work. (one page report)
16	Survey of Scientific Activities of Instructions of Higher Education (NSF) (Every two years)	I. Number of employees engaged in research, by detailed subject break down. II. Expenditures, by source of funds
17	Proposals submitted to outside agencies. (weekly)	List of proposals submitted each week, giving award starting and ending date, total award amount, sponsor, ORA proposal no, title, and project director. Listing is by status (proposed, accepted, rejected).
18	Quarterly Report of Proposals outstanding (Quarterly)	List of proposals submitted to sponsors that have not been accepted as of quarterly date.

O.R.A. Report	Content
Quarterly Summary Report of Proposals Outstanding (Quarterly)	Counts of Outstanding Proposals (Number and total dollars) by sponsor and by University unit, including computation of acceptance rates.
Report to State Board of Education on the Acceptance of Awards from other than general Funds (Semi-Annual)	List of projects awarded for 6 month period, containing information of Department, Sponser, Starting Date, Dollar Award, and Months Duration Present computer listing also contains ORA number, project director, type of grant, and field of study.
Case Report (NSF) survey of manpower engaged in Federally Financed Academic Science programs. (Annual)	List by contract of types of people (and dollars) working on NIH, NSF, and OE sponsored projects.

REPORTER

Issued Twice Monthly by
The Division of Research Development and Administration

A BULLETIN ON ACADEMIC AFFAIRS FOR THE FACULTY AND STAFF OF THE UNIVERSITY OF MICHIGAN

January 15, 1974 / Vol. XX / No. 14

RACKHAM FACULTY RESEARCH GRANTS

The Dean and Executive Board of the Graduate School invite faculty research grant applications at this time. Any faculty member on academic appointment who is receiving part of his salary from the University and conducting research as part of his University duties and who has regular assignments as a teacher of formal courses and is not a doctoral student, is eligible for a grant.

Applications may be obtained in Room 1014 Rackham (764-4405) and are due at the Graduate School not later than Friday, February 1, 1974, for funding beginning May 1, 1974.

MICHIGAN MEMORIAL--PHOENIX PROJECT FACULTY RESEARCH GRANTS

During the Winter Term, the Michigan Memorial--Phoenix Project will make a limited number of grants to support research in the peaceful uses of nuclear energy. This includes work in the social sciences as well as the physical and biological sciences.

Since the amount of money available is small, requests for $3,000 or less will be considered appropriate. Grants may cover equipment, supplies, research assistance, and field trips. The Project will not pay the salary of the principal investigator, nor will it pay publication expenses.

Because of the many requests for Phoenix support, only those projects that are rated "excellent" or "very good" by the Divisional Review Boards are likely to be considered for funding. Priority will be given to: (1) new faculty, particularly to those who need funding in order to seek research support from outside agencies, (2) established faculty who need assistance in opening a new area of research. Applications from faculty who have previously received extensive Phoenix support will be given lower priority. Applications for grants should be returned to the Phoenix Project by Friday, February 1, 1974. Grants will be made by April 1, 1974. Application blanks may be obtained from the office of the Phoenix Project at the Phoenix Memorial Laboratory on North Campus or by calling 764-6213.

GENERAL HYDROMECHANICS RESEARCH PROGRAM FOR FISCAL YEAR 1975

The General Hydromechanics Research (GHR) Program, sponsored by the Naval Ship Systems Command, is concerned with naval hydrodynamics--primarily problems related to the design of ship and submarine hulls and appendages. In addition, work in the following areas will be encouraged:

a. flow problems associated with high performance craft such as surface effect ships
b. subcavitating and supercavitating hydrofoils
c. planing craft
d. multi-hulled vehicles

The deadline for submission of proposals is March 15, 1974. Informal written inquiries to ascertain the suitability of research ideas for the program are encouraged and will be accepted until February 1, 1974. Please address your inquiries to:

Mr. Stuart F. Crump
Contract Research Administrator
Naval Ship Research and Development Center
Bethesda, Maryland 20034

For further information, contact Mr. Kenneth Burns or Mrs. Mary Barnett at 764-7250.

NSF INSTRUCTIONAL SCIENTIFIC EQUIPMENT PROGRAM

The Division of Higher Education in Science of the National Science Foundation has announced a February 15, 1974, deadline for receipt of Instructional Scientific Equipment proposals. Awards will be announced after June 1, 1974.

The purpose of the Foundation's Instructional Scientific Equipment Program is the implementation of a new or improved undergraduate instructional program in one or more of the sciences by providing partial financial support for the purchase of scientific equipment. Therefore, proposals will be evaluated in terms of (1) the degree to which the new instructional program represents an improvement over its predecessor, (2) the suitability of the proposed change to the student audience and to the academic context in which the project would operate, and (3) the degree to which the equipment to be purchased is necessary to the implementation of the new program.

For further information, contact Mr. Martin Tobin, 763-1268.

ROCKEFELLER FOUNDATION FELLOWSHIPS IN CONFLICT IN INTERNATIONAL RELATIONS

The Rockefeller Foundation has announced a new program entitled "Conflict in International Relations." The program will have three major objectives: (1) to identify and assess emerging areas of international affairs likely to be of major importance in the decade ahead, (2) to facilitate new conceptualizations of these problems and the development of alternative approaches to their solution for the benefit of policy makers and others concerned with progress in the development of international order, (3) to help develop needed additional expertise in these policy areas. Special attention will be given to the broad range of problems related to "conflict"--not only international conflicts but also those within regions or nations.

Approximately 15 awards for one-year tenure will be made during the first year of the program. They will cover maintenance, travel, and other approved costs. Guidelines for the general program are being developed.

For further information, contact Mr. Lee Beatty, 764-7247.

SPONSORED ACTIVITIES SEMINAR JANUARY 24, 1974

A seminar on sponsored activities open to all staff and faculty members will be conducted by the Division of Research Development and Administration, Office of Contract Administration, and the Department of Accounting. The seminar will cover briefly all aspects of applying for grants and contracts to agencies outside the University, and accounting for funds, property, etc., to the sponsor. Topics to be covered will include selection of potential sponsors, proposal preparation, budgeting, grant and contract administration, as well as legal and fiscal reviews, property, and accounting.

The seminar will be held in the Rackham Amphitheatre from 1:30 to 4:30 P.M., Thursday, January 24, 1974.

U-M BLOOD DONORS ASSOCIATION WINTER CLINIC

On Tuesday, January 22, 1974, from 2:00 P.M. to 8:00 P.M. and on Wednesday, January 23 from 9:00 A.M. to 3:00 P.M., The University of Michigan Blood Donors Association will open its rolls for new/renewal members. This Winter Clinic will be held in the Commons Room of the North Campus Commons.

Current members can donate at this clinic to extend their membership and new members are invited to join the Association at this time. The Association would like to remind the University community that there are always fellow staff members who are unable to donate for various reasons and are in need of proxy donors. Any person who wishes to donate on January 22 or 23, should obtain an application from the Staff Benefits Office, 2030 Administrative Services, 764-5259. Donors are reminded that it is necessary to schedule an appointment to avoid unnecessary delays.

SPONSOR DEADLINES FOR RECEIPT OF APPLICATIONS

Listed below are some of the deadlines occurring within the next few months. For assistance call the DRDA staff member whose name is given in parentheses. Telephone numbers: Mr. Beatty, 764-7247; Mr. Burns, 764-7250; Mr. Greenway, 764-7242; Mr. Plawchan, 764-7238; Mr. Tobin, 763-1268.

SPONSORING AGENCY and Program Title	Deadline
AMERICAN CANCER SOCIETY, INC. (Mr. Beatty)	
Research and Clinical Investigation Grants	Apr. 1
Postdoctoral Fellowships	Mar. 1
Faculty Research Awards	Mar. 1
DAMON RUNYON-WALTER WINCHELL CANCER FUND (Mr. Beatty)	
Research Grants	Mar. 15
EPILEPSY FOUNDATION OF AMERICA (Mr. Beatty)	
Research Grants	Apr. 15
Graduate and Undergraduate Fellowships	Apr. 15
Training Grants	May 1
EXXON EDUCATION FOUNDATION (Mr. Beatty)	
Educational R & D Program, Preliminary Proposals	Mar. 1
FIGHT FOR SIGHT (Mr. Beatty)	
Postdoctoral Fellowships and Grants-in-Aid	Mar. 1

SPONSORING AGENCY and Program Title (Cont.)		Deadline
NATIONAL ENDOWMENT FOR THE HUMANITIES (Mr. Tobin)		
Division of Education Programs:	Development Grants	July 1
	Planning Grants	Mar. 15
	Program Grants	July 1
	Project Grants	Mar. 15
Division of Fellowships and Stipends:	Senior Fellowships	June 17
	Summer Seminars	Feb. 11
Division of Public Programs:	Community Education Grants	Feb. 15
	Film/TV Grants	June 1
	Interpretive Exhibition Grants	Feb. 15
Division of Research Grants		May 6
Youthgrants in the Humanities		Apr. 1
NATIONAL INSTITUTE OF EDUCATION (Mr. Beatty)		
Research Proposal Prospectuses		Jan. 28
NATIONAL INSTITUTES OF HEALTH/ALCOHOL, DRUG ABUSE, AND MENTAL HEALTH ADMINISTRATION (Mr. Greenway)		
Individual Fellowship Program		May 1
Institutional Research Fellowship Award Program		Sept. 1
NATIONAL SCIENCE FOUNDATION (Mr. Tobin)		
Higher Education Programs (Graduate and Undergraduate):		
Alternatives in Higher Education		Open
College Faculty Workshops		Open
Field-Initiated Studies and Experimental Projects		Open
Instructional Scientific Equipment		Feb. 15
Minority Institutions Science Improvement		Open
Restructuring of Education Programs		Open
NATO Senior Fellowships in Science		Jan. 31
Pre-College Education Programs (Elementary and Secondary)		
Field-Initiated Studies and Experimental Projects		Open
Materials and Instruction Development		Open
Restructuring of Education Programs		Open
RANN: Decision Related Research on the Organization of Service Delivery in Metropolitan Areas		Jan. 22
PUBLIC HEALTH SERVICE (Mr. Greenway)		
Research Grants:	Competing Renewals	May 1
	Maternal and Child Health Grants	Mar. 1
	New and Supplements	Feb. 1
	NIMH Small Grant Applications	Feb. 1

APPENDIX C

NSF Interviews
University of Wisconsin--April 16 & 17, 1974
William Toombs

Interview with: Robert M. Bock, Dean of the Graduate School
and
Carol M. Miller, Assistant Dean of the Graduate School

Notes on Structure: The Dean of the Graduate School is a permanent full-time appointment; but the Associate Deans, about five of them, are half-time, released from their faculty positions to work with the Dean's administrative office on matters of admission and other kinds of informal liaison. The Assistant Dean holds an administrative role and apparently is a full-time appointment.

The Graduate School is budgeted as a college and has funds under its direction to support a number of specialized projects. The notable one that occurred again and again was the Biotron which supports studies of a controlled environment. The Dean is also in a position to offer financial support for new faculty appointments covering such things as preliminary summer salary or special releasedtime. Also under the office of the Dean is an Associate Dean for Research who performs some of the functions normally carried out by a research administration office. This is Dean Rude. The main structures in the Graduate School that deal with research are (1) The faculty research committee composed of 34 members appointed by the Dean for three-year overlapping terms. Occasionally they are retained for four years, and the arrangement is apparently informal. (2) Divisional boards. Members to the divisional boards are elected, and these are broadly representative of major fields of study--biology, humanities, social sciences, etc. Principal functions of these boards are academic review both at the course and program level and in terms of promotion and tenure. Tenure review and pro-

motion have been tightened considerably under the control of these boards; and although the deans have ultimate power and appointment, they have never gone against a recommendation of the board. Generally they come back next year with a new recommendation.

While the Graduate School is responsible for special projects in program areas, there is no formal mechanism for inter-disciplinary or multi-disciplinary programs. Nor is there any particular supervision for the establishment for institutes and centers. Dr. Rude cited a list he had made of 141 named activities. So long as these are not independently budgeted and meet with the approval of the Dean of the College, they create no problem.

State funds come to the Graduate School in three different and distinct forms. (1) There is a category that might be labeled Budgeted Departmental Research. Since the "merger," that is the creation of the Wisconsin University system, a standard budgeting practice is followed which generates a line-by-line salary statement for each individual faculty member. Faculty compensation is separately identified as being on an instructional budget or on what they call a "101" budget, which is the state designation of a research activity. There is no standard proportion of budgeted research time for individuals, and some are on a full-time instructional budget.

The second category of state funds are programs, most of them in agriculture, which have been established by the legislature upon recommendation. Under the current budgeting practices, the University is required to report all such programs in a ranked order each year; and the bottom ten percent are vulnerable to all sorts of decisions. Some of these decisions involve flat budget cuts which require the termination of such programs. In other cases the approval for new programs in

agriculture is contingent on the removal or replacement of one of the lower ten percent programs. To quote the Dean, "This is a hard but effective management policy." Practice was introduced by the legislature which discovered that some programs had been on the books for as long as 30 years and funds had been adapted by the agriculture department to other uses. This offset funding for new programs has apparently become a basic principle.

(3) A block grant of state funds is also provided each year, subject to some negotiation, to be combined with the WARF funds. Originally, these grants from the state legislature were provided because the humanities were not covered by WARF programs. Distribution of the funds is under the Faculty Research Committee, just as all the other WARF funds are, and it is loosely structured so that the exact amount need not go to humanities in any given year.

Faculty Research Committee: Through this Committee the evaluation and allocation of research funds within the University are rather highly centralized. The members of the Committee are representatives of the University interest at large and not representatives of the department or division in which they are specialized. This concept of a professional role in the University community as well as a role in the departmental discipline is highly distinctive. The concept at work here suggests that one's peers are not necessarily those in the same field of specialization, for peer relationships include all those colleagues in the University community. This Committee takes a great deal of time with its deliberations, and apparently works through many Saturdays during the Fall term to arrive at its conclusions by the first of the new year. Grants are customarily given for a period of one year and are renewable, but an application must be made. The amount of work is prodigious, and at one point reference

was made to possibly 450 grants funded out of 700 applications.

The purposes for which grants are used might broadly be referred to as "seed money" or as developmental funds. The intention is that these grants will have an instrumental effect by prompting outside support or advancing a person in a significant part of his professional growth. Young professors receive priority and those applying shortly after arrival are almost assured of first-time support. The unit of proposal is a single project by a single man, but occasionally combined efforts or program proposals have been supported. There are distinct advantages in the flexibility available to this Committee, for exceptions they recommend can be approved by the Dean. Occasionally approvals are made on a contingency basis, that is to say they will become effective if the person turns in a complete proposal to a funding agency or if the person does not receive approval for a grant that is already in. Thus, they function as backstop or "insurance" grants. The apparent intention of all internal funding is to lead to visible and assessable outcomes, such as outside funding, a substantial piece of work. No program or project is funded on a sustaining basis.

The largest share of the grants go for salary replacement to pay for released faculty time. There is a strong preference for a full-time grant released for research purposes rather than partial support, and summer grants constitute a sizable share of the awards. Because the funds are cash funds rather than appropriations linked to fiscal year there is a good deal of flexibility available to the Committee over the time that they are used and this increases effectiveness of the whole program.

Procedures used by the Committee are both informal and complex. Applicants turn in a brief statement along with the full proposal, a form is attached, and all members of the Committee read the abbreviated statements. One of the most unusual features of this Committee's operation is that they apportion out the applications among members of the Committee and these individuals make, what are called on the campus, "site visits". An individual has about 20 to 25 site visits to conduct during a period of the fall and winter terms. Essentially the site visit can consist of an on-location interview with one of the applicants and they involve a very detailed analysis of the project itself. A report of this visit is prepared by the Committee member and it includes all aspects--funding, time use, merits of the project. The interviewer depends not on some prepared criteria, but on a total grasp of the activity that is proposed. There is a maximum of informal interchange suggestion of shortcuts, other sources of funding, similar projects elsewhere in the University, and essentially a thorough justification of the plan. No outside reviewers are used at any point in this process. The site visit technique is an unusual one and, in spite of its time consuming nature and certain hazards of bias and cliqueishness, it insures that a proposal will be looked at from many angles by people of different experience, all faculty, before it is finally recommended to the Dean by the Committee. Proposals are rated on a one, two, three, four, five basis and an informal ranking within these priority groups is assigned by the Committee. Because the exact

amount of funds are not known in advance, the Dean has to have leeway to reject or accept marginal proposals.

There are, of course, ancillary benefits to the Graduate School arising from this centralization of power. The quality of departments that seem to merit attention can be upgraded. The results of such a rigorous screening are considered as a favorable sign by Promotion, Tenure and Appointment Committees, as well as department heads, and the Graduate School has a direct share in shaping future directions.

Research Policy: Throughout the emphasis is on the development of outside funds. The program has a forward orientation and there is no post facto review and no systematic collection of information about the projects as they are in progress or as they are completed. There has been no great pressure to participate in general information systems and abstracts of internally funded projects are not disseminated in any way. There is no systematic summary of equipment available across the campus and no periodic report of on-going projects. There is not even an annual report of on-going research within the University. The forward orientation continues into the department and college level on an informal basis. Apparently by custom the various colleges have a planning group that spends a share of its time talking about research directions and research needs in the field. There appears to be a distinct emphasis on looking towards future requirements and fields of development. This is not done on the University-wide basis however, but within the college.

The climate of research: These observations are drawn from the conversation with Eric Rudy, the Associate Dean for Research, who is a member of the Graduate School staff. Many of the functions performed by Offices of Research Administration are carried out informally through personal exchange. No printed summaries of funding opportunities are distributed and the

communication structure is exactly the opposite of that which is characteristic of University of Michigan and other institutions. This reversal is carried over to the support functions and the preparation of proposals for external funding is done within the college. Research support funds are incorporated into the normal budgeting for the college. Guidance in preparation comes from senior faculty and from a few administrative assistants who are cognizant of budgetary needs and procedures.

Summary: The distinctive features are:

1. The use of site visits by faculty research committees to check out the details of proposals for internal funding.
2. Heavy dependence on informal internal communications to identify areas for research and methods of applying.
3. The absence of any stated criteria or formalized procedures to be used by committees or committee members or boards in looking at the research projects.
4. The enormous investment of individual faculty time devoted to gathering information about proposals and to pre-screening them before a recommendation is put before the committee.
5. The absence of any mechanism for dealing with multi-faceted projects or initiating programs that reach across faculty lines.

NSF Interviews
University of Wisconsin--April 16 & 17, 1974
Herschel Leibowitz and William Toombs

Interview with: Dr. James J. Skiles
and
Norman Hildebrand
University Industry Research Program (UIR)

Dr. Skiles confirmed the financial information that the Faculty Research Committee uses $4-5 million with $4 million coming from WARF. The remainder comes from a state grant. The Engineering College gets $900,000 which are called "research" funds from the state, but they can be used freely to cover operating expenses, grants, and even assistantships. A general report of research activity is made to the Wisconsin legislature every two years.

The UIR--University Industry Research--program has the primary function of maintaining liaison within industry to improve the economy of the state. Because the initiative is with the University in opening its contacts and maintaining them, the effect is to allow participation in worthwhile research on its own terms. Skiles made clear that they have avoided a problem-solving orientation and have discarded any testing activities. Through contact with industrial operations throughout the state, they locate areas of mutual interest in which both industry and the University are doing research or areas where the two could collaborate.

The UIR funds come from WARF and from gifts, often from industries that participate in their programs. They do not generally do contract work. The following specific activities were identified:

(1) UIR supports some projects in the initial stages when they are not up to the research standards of the FRC but are valuable in their own right.

(2) They disseminate "research capsules" and longer articles through a research newsletter which distributes 8,000 copies. In preparing this the UIR joins with the technical writing research program and employs six to eight graduate students in technical writing. In addition to about four periodical publications a year, these staff members make about 180 press releases on research activities.

(3) UIR issues timely reports on somewhat controversial subjects. These are heavily information-based and they deal with subjects like Project Sanguine, the Navy proposal for low frequency antenna base carved out of the woodland areas of Northern Wisconsin; or the Chippewa Flow Problem in which power and other commercial dams on the Chippewa Reservation have disrupted the ecology of the area.

(4) The UIR also joins its support with those of the Colleges and the Graduate School when there is an industrial application. Somewhere between two-thirds to one-half of the projects supported by UIR are referrals from the FRC. Typical of these projects are the Energy Storage Project which allows for the storage of electrical energy at cryogenic temperatures, methane generation from organic wastes, solar energy application to housing, high tensile quick-drying concrete.

(5) There is a long lead time to projects supported by UIR and they expect application a year in advance. The Institute does have the capacity for instant response, but proposals are normally expected well in advance of activation.

The criteria used for decisions are: (1) timeliness, (2) the policy implications of the study, (3) the expectation that industrial research will develop out of it or be supplemented by it, (4) there is a potential for commercial and industrial research which will lead to marketing.

Business contacts are brought into the picture with their information and as recipients of information whenever there appears to be even the slightest tie. Seminars on marketing problems or special developmental problems are held regularly. The UIR works not only with business, but with hospitals, with municipal government, and other non-profit agencies. They work closely with a sponsored research office (Ericson) after projects are funded. They also offer excellent technical and scientific input into the legislative process by means that are largely informal but effective.

NSF Interviews
University of Wisconsin--April 16 & 17, 1974
Herschel Leibowitz and William Toombs

Interview with: Henry J. Sallach, Physiological Chemistry (Toombs, Leibowitz)

The Chairman of the Medical School Committee on Research is also a member of the faculty research committee. He has had three years of experience as Chairman of the Medical School Research Group and its operation is similar to the Graduate School counterpart. This committee, too, is appointed with overlapping terms of approximately three years. Site visits by committee members to those proposing research is also followed and occasional consultation with the department head by the committee chairman, gives additional information. While most of those engaged in site visits are in the field, this is not considered a necessary requirement. Those in the same department disqualify themselves from voting on proposals in their respective departments. The interviewer on the site visit performs several functions in addition to screening the project itself. They are informal communicators armed with information about who else in the University is doing similar work and where equipment is available. Again, the function of the committee is recommending but the Dean usually accepts the recommendation. Exceptions appear when special agreements have been made at the time of appointment. The ranking and priority system evolving a single number in reflecting the judgment of the committee is used.

In its deliberations the committee keeps the following priority system in order:

1. New staff. Funds from the committee are considered a usual form of support for new staff members in their first several years.

2. Older, more seasoned investigators who come from other campuses and are in a state of transition receive second priority. This is the area in which most of the difficulties appear because of prior commitments by department heads and the Dean which obligate the committee decision in advance. This has not, however, been a serious problem.

3. The novel idea, an idea that is worth working on and everyone agrees with working on but has not yet built up enough data or information to support a proposal.

4. Tie-over funding, "bail out" funding has become increasingly important as federal training grants and programs became more uncertain. Within the past two years the University has succeeded in getting funds from the State Legislature for the express purpose of supporting some of the curtailed federal traineeships.

In addition to the war funds and this new emergency funding there is apparently some money available from what is called the "University Houses Fund."

In the Medical School the emphasis again is on one-year programs and, again, on paying for release time or the salaries of student assistants.

There is no automatic sabbatical anywhere in the University and study leaves must be applied for individually by professors. University funds can be used in conjunction with other external grants but they are applied after the other grants have been considered. They can be awarded at any time of the year and an annual cycle is not mandatory. The fiscal side of grants and management is taken care of separately as an accounting matter. Although reports are directed to the Chairman of the committee and committee members, they are not used as a means of monitoring on-going research. Faculty contracts are on an academic year basis and grants from the Graduate School Research

Committee generally cover either summer time or another term. Dr. Sallach pointed out that the system has considerable inherent stability which has enabled it to survive several changes in medical Deanship in a very short time.

NSF Interviews
University of Wisconsin--April 16 & 17, 1974
Herschel Leibowitz and William Toombs

Interview with: Camden A. Coberly
Associate Dean, College of Engineering
and
Executive Director of the Engineering Experiment Station
University of Wisconsin

The Engineering Experiment Station has a long history and draws its principal support from the $900,000 of state funds provided each year under the research tag. These monies support the operation of research offices and are shared with the departments to provide facilitating support for the preparation of research proposals. It is clear that throughout the University the research proposal is the fundamental unit presented by the individual professor for consideration. Again, there is diversity to the type of support, ranging from summer term support to gap-filling appropriations to tie-over areas of non-renewal. New projects are approved for support by administrative decisions which combine the department head's observations with those of the dean and those of the director of the experiment station. Graduate student stipends constitute a large portion of this grant.

The principal function is to stimulate areas of research that are not ready for formal application. Eventually these may be formally proposed to either the FRC or to UIR. The illustration used was cryogenic tire recycling. Old tires are frozen by liquid nitrogen and separated in a hammer mill into components of rubber fiber and steel, each of which is separately reclaimable.

The Engineering Experiment Station's function is "facilitating" research. Sometimes this involves part-time appointment of faculty so that initial developments can be conducted, for example, air pollution,

rheological research, or interdisciplinary efforts. The Experiment Station has no special faculty. All academic appointments in the Engineering College are de facto members of the Stations.

Dr. Coberly emphasized the tradition of openness in research support for faculty at Wisconsin. The initiating factor is faculty interest, and once that is established, the college or one of the other agencies attempts to find appropriate support. There is a similarity here between Wisconsin and Michigan in that various organizational forms, each with its own particular set of mission definitions, are available to follow through on faculty research interests. Coberly observed that there is a lack of formal structure at the faculty level. A man works primarily for himself and faculty interests represent a wide diversity. Individuals generate a great many proposals and when these fit into the appropriate organizational slot, they generate outside support.

To the question of how you treat a bad project, Dr. Coberly offered the following comments: "Research polices itself." The resources of the people involved in projects tend to reshape their direction. As an illustration he used hybrid computer effort which was established on a very expensive basis but did not seem to be taking hold. When the costs levels were reviewed, some of the people who developed the initial idea moved out and a director who was practically oriented moved in to reorient the project. Another case was the MURA project which was initiated to cultivate research that would attract the large scale reactor the government was going to place in the Mid-West. When the reactor was finally located at Weston, Illinois, this group reshaped its own operations to develop new areas of theoretical and high energy physics and make use of facilities already built in Southern Wisconsin.

Coberly pointed out that when the Wisconsin State System emerged, WARF became specific in its support to the Madison campus. He noted that there are some system-wide programs, notably SEAGRANT, and that there are still

some residual ties with the Milwaukee campus. While these are phasing out in their traditional form, system-wide programs are developing in new forms under federal sponsorship. He observed that Madison was likely to take the leadership in developing state-wide systems of research in the highly specific areas.

NSF Interviews
University of Wisconsin--April 16 & 17, 1974
Herschel Leibowitz and William Toombs

Interview with: Robert Hougas
Associate Dean and Director
College of Agriculture and Life Sciences
University of Wisconsin

Dean Hougas had gone to considerable trouble to answer in detail and with documentation the questions raised in the letter. He opened his remarks by pointing out that the departmental structure is a fundamental factor in Wisconsin's academic activity. The Departmental Executive Committee is the source of continuing power and is elected by the faculty at large. The chairman of the department is elected yearly and transmitted to the dean for approval. This provides a freedom of association among faculty that allows them to work together as long as they want to. The chairman's terms are, of course, renewable and the Executive Committee is elected.

He also pointed out that the approach to research is to first locate needs and then invent the structure to satisfy them. Hougas spelled out in detail some of the fundamental principles he had developed and they are exceptionally fine. He emphasizes communication among all members working on a particular project, clear definition of roles, and dissemination of new ideas throughout the University structure. To develop research in any particular area, stimulation begins at the grass roots, that is with the individual faculty members. He is experimenting now with a series of financial incentives designed to bring more group research on an inter-disciplinary basis. His reasoning behind this is that as problems become more complex they require larger chunks of money to get started and he feels we are entering a new era in research. Eventually up to $200,000

a year will be available only to group projects. About 18 proposals have been received this year for such activity. The individual professor still may take his proposal to the Graduate School FRC. The question sheets provided by the dean indicate the pragmatic guidelines for group research projects.

The peer system review is applied in an unusual way. Citing the fact that external proposals, proposals to the FRC, and proposals to the UIR all receive peer scrutiny, the Agricultural School decided that internal funds should be dispersed in the same way. Approximately 1.8 million of HATCH ACT funds are dispersed within the College using a peer review structure. Using federal guidlines for assessing both the proposal and the professional competence of the principal investigator, the College Research Committee makes a critical review. Comments of the reviewers in the form of a critique are sent back to the proposor, but no site visits or interviews are conducted. A large number of proposals are sent back for revision but in spite of the fact that reviewers are colleagues, there have been only one or two bad reactions.

In additional observations he pointed out that for any project multiple funding sources were preferred, that contact with industry was encouraged, and that communication of activity throughout other related University departments was absolutely required.

Dean Hougas also summarized the philosophy of the University and the College with respect to research. Once a man is appointed the University recognizes an obligation to support him at the minimum level in order to give him the freedom to do what he is prepared to do. The idea is that if he gets enough help at the start, outside support will develop. As time goes on the constraints are increased for internal support and assistance for external development increases. He pointed out that over

the longer range he was concerned about developing agencies of self-renewal within the faculty and about the encouragement of new creative directions.

APPENDIX D

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DATE: May 7, 1974

FROM: Dr. William Toombs

TO: NSF Committee

SUBJECT: A Comparison of Research at Wisconsin and Michigan

From the policy documents and interviews at two major research universities, Wisconsin and Michigan, a number of common factors emerge. They are not written out in any comprehensive statement at either institution, but they emerge quite clearly from the phrases and labels used by interviewees, from the procedures that are followed, and from the priority in which activities are held.

A. Common Attributes

1) Attention is concentrated on the early steps of the research process. Cultivating a good idea, initiating a new technique, working through the first stages of a process--, in short, the launching stage,-- is the focal point for support and critical evaluation.

There is almost no retroactive review of research projects on a large scale. Information systems for collecting and keeping track of ongoing or past projects are absent or casually maintained. Monitoring projects is minimal at Michigan and absent at Wisconsin, where the short cycle of awards makes it unnecessary.

2) The "project" submitted and conducted by an individual researcher is the basic unit of research activity. The fundamental descriptive format is a proposal. In this form the initial idea is examined, criticized, and often resubmitted. The faculty member with a good idea is the central component rather than a grand strategy for the university or even a tactical plan in a department.

3) Time cycles are short. The aim of research programs is to get suitable resources into the researcher's hands for a specific period of time. Internal awards are tenable for a year, sometimes renewable up to three, but in no case is a project given endless support. Under internal research procedures, programmatic support is rare and departments, institutes, or centers are regarded as more appropriate.

4) There is a clear expectation that projects will search for outside funding. This does not mean that only fundable projects are taken up and continued, nor does it mean that unfunded projects are automatically dropped. The idea is to develop as much external support as possible. Some projects still gain support because they are high-risk exploratory efforts, or worthwhile scholarly inquiry; but the reason for supporting them is clear.

5) The overall organizational pattern is similar. There is a major central unit (the Graduate School at Wisconsin, the Vice President for Research at Michigan) and a variety of outlying units. In each case: (a) One set of units is specialized to deal with external publics; industry, legislature, state and federal agencies. (b) Others have designated internal purposes; faculty development; dissertation support, laboratory or other research support services. (c) There are few organizational units that are not functionally related to research. Bureaucratic activities are kept out of the main stream.

6) Strong departments play a key role. There is a share of administrative and budgetary "slack" at the department level. This slack is tied into research support. In Wisconsin a share of salary and time is identified specifically. In Michigan lower work loads at universities are set to allow for research time. Time, some clerical support, guidance for young researchers, and planning strategies for research directions are all provided first at the department level. This is not considered an auditable resource, but it is clearly identified and accepted.

7) Communication levels are high and consciously sustained. The methods are different; formal at Michigan, informal at Wisconsin. The emphasis was similar: Get as many people as possible informed about projects and proposals as early as possible. Cross references and shared suggestions were emphasized. This may account for the fact that no outside reviewers were used at either institution, nor was a specific review of research activity conducted.

8) Evaluative reviews are directed at a complete administrative unit. Administrative or programmatic units, such as departments and centers, are evaluated as total components. Research, education, faculty development, and program quality are not separately reviewed. A number of issues, such as promotion or tenure, are treated in an all-university setting so that, in effect, yearly sub-evaluations are made.

9) A sizeable Fund of Flexible Resources is maintained to support research. The origins differ and they change, but a discrete research fund is seen to have major importance. In Wisconsin funds come from WARF, the legislature, and others. In Michigan they come from Rackham Endowment, institutional allowances on federal programs, and general fund budget. The utility is increased because they are not limited to the fiscal year, can be applied at any time, can be used after all regular appropriations and encumbrances are made, and can be supplemented by special appeals.

10) Careful attention has been given to the stages of development and innovation. Michigan is newer at this than Wisconsin, but patent and copyright policies have been restated, development agreements with Battelle and others constructed. Wisconsin Alumni Research Foundation is the prototype on this subject.

11) Both institutions are searching for: (a) a method of initiating needed research quickly by stimulating the pool of faculty talent, (b) an effective method of conducting "team" or multi-disciplinary research.

B. Points of Differences

The considerable differences between Michigan and Wisconsin in their approaches to research activity are chiefly organizational. Wisconsin has developed a strong graduate school as the central vehicle for (1) awarding internal research grants through a Graduate Faculty Research Committee, (2) reviewing promotion, tenure, course and program proposals through several Divisional Boards. Research awards develop a project internally for a year before it goes outside for funding. In effect these awards lay a groundwork of research throughout the university. Funds are usually directed at "internal" costs; faculty time, assistants' time, minor equipment, computer time. The process of screening proposals is labor intensive, but this pays large dividends in communication and referral. There is almost no formal structure to circulate information on funding or maintain liaison with funding agencies. Faculty do this on departmental funds. Because of the short cycle of awards, no monitoring of projects is necessary beyond accounting office routines.

In contrast, Michigan is more structured, more formalized. The central units are the Office of Research and Development Administration (ORDA) and the Vice President for Research. The purpose here is to get good ideas from the faculty to potential funders in the best form and shortest time possible. Research support activities are emphasized: editorial and fiscal analysis; printing, illustration, and delivery: liaison and follow-up; monitoring and close-out. The peripheral agencies range from very specialized centers and institutes to the Rackham Graduate School Program. This latter activity awards faculty fellowships, faculty grants, student dissertation grants, and some department development grants. All awards are monitored with the monthly budget reports standing as management indicators. Centers, Institutes, and joint programs are strictly controlled in both formation and operation. At Wisconsin they are not until they get a budget!

This comparison suggests that there may be a common factor in what is done, the functions, even though there may be variation in how it is done, the form.